ENDEVCO

DYNAMIC INSTRUMENT
DIVISION
DIVISION OF BECTON, DICKINSON AND COMPANY

INSTRUCTION MANUAL

FOR MODEL 2718A

SHOCK AMPLIFIER

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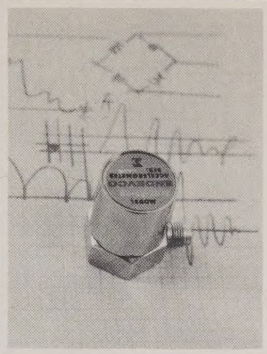

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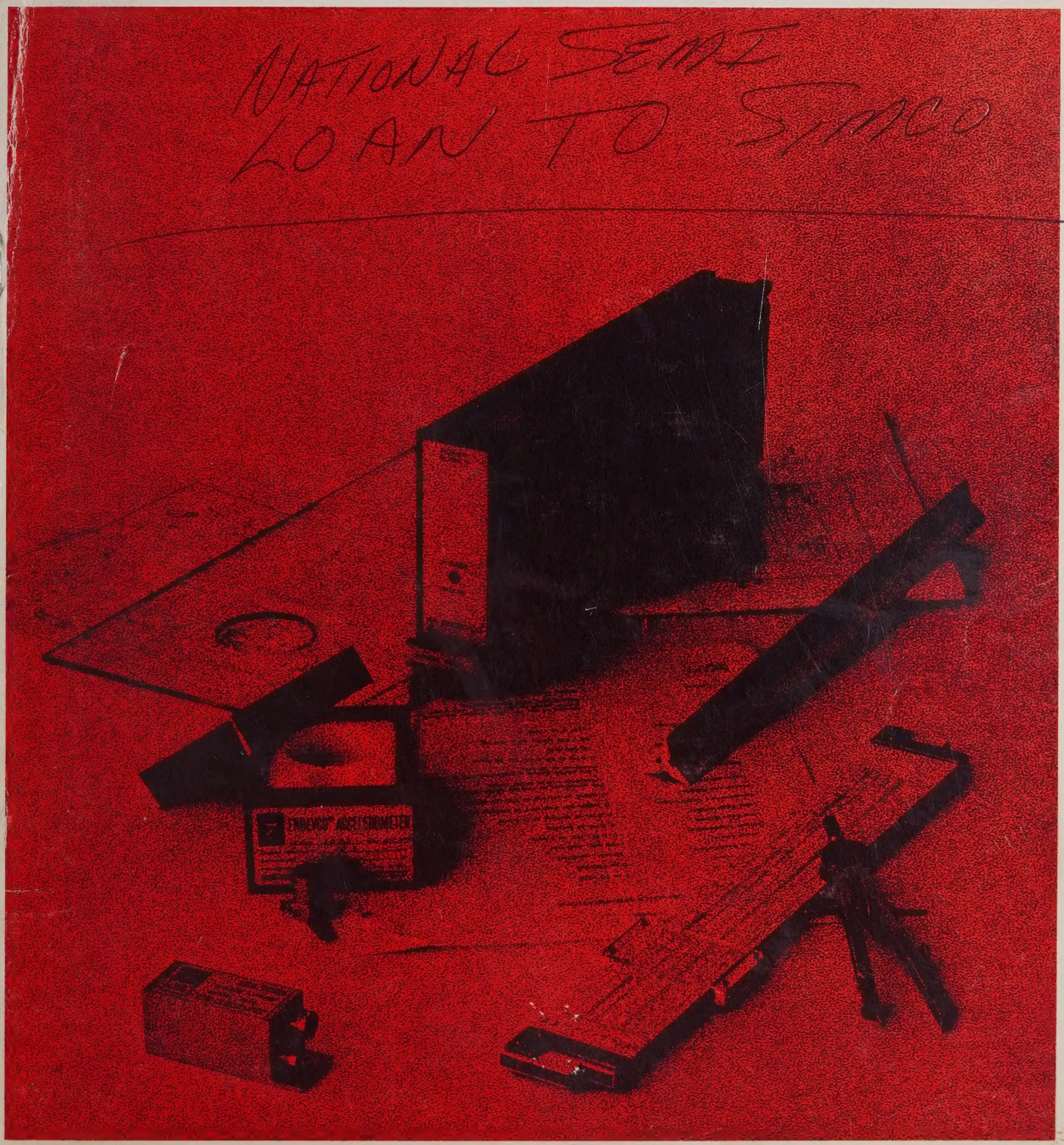

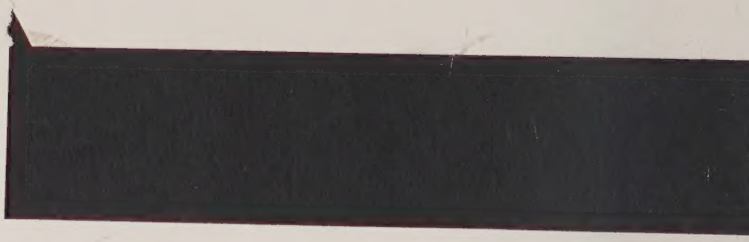

INSTRUCTION MANUAL

FOR MODEL 2718A

SHOCK AMPLIFIER

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ENDEVCO PRODUCT DATA

MODEL 2718A
SHOCK AMPLIFIER

GENERAL DESCRIPTION

The Model 2718A Shock Amplifier is a charge amplifier designed specifically to meet the signal conditioning requirements of shock measurement. The wide frequency range and wide dynamic range of the amplifier permits accurate measurement of a wide variety of shock impulses — from rapid rise times to long durations. It is also suitable for measuring random and sinusoidal vibration.

Charge amplifiers sense charge at the input and produce a voltage output directly proportional to the input charge. This permits the use of long cables without attenuating the sensitivity of piezoelectric transducers. It also eliminates the task of computing the effect of various capacitance values on output. Signal cables may be changed without requiring system recalibration. Low frequency response is independent of transducer and cable capacitance.

Modular functionalism is stressed in the design of the Model 2718A and its associated accessories. The Model 2718A can be housed in a single or dual protable carrying case, or in a 19″ rack with one, two or three amplifiers per rack.

A Peak Holding Meter, Model 2954A, is available with the Model 2718A to indicate the maximum amplitude of a single pulse or a series of pulses from any piezoelectric transducer. It permits the operator to visually determine the pulse amplitude. The Model 2954A is compatible with the Model 2718A Shock Amplifier modular design in either the rack mounted or portable configuration.

OUTSTANDING FEATURES

ALL SOLID STATE

PULSE DURATIONS as long as 600 milliseconds and as short as 33 microseconds

SYSTEM MODULAR DESIGN and mechanical accessibility

LOW PASS FILTERS built in

LONG INPUT CABLES with up to 100,000 pF capacitance

INTERNAL SINUSOIDAL CALIBRATION SIGNAL

CALIBRATED SENSITIVITY DIAL

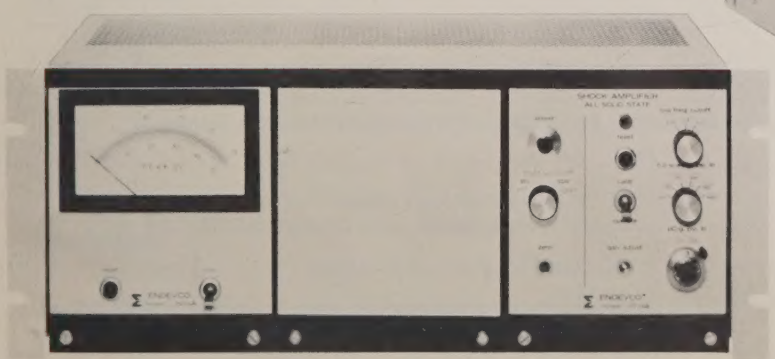
GAIN RANGES IN FULL SCALE g

LOW NOISE

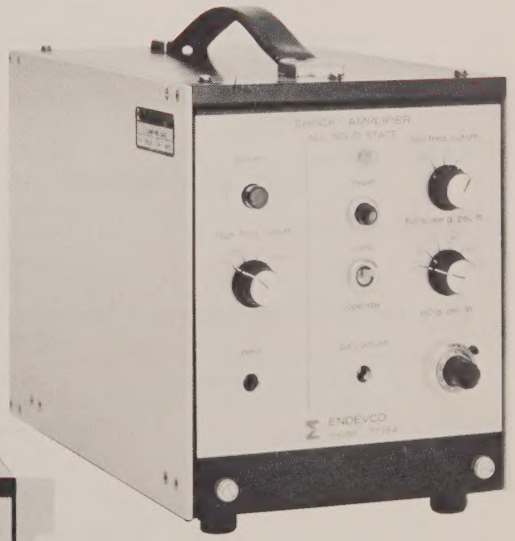
POWER OUTPUT provided for driving galvanometers

NEGLIGIBLE SUSCEPTIBILITY TO LINE NOISE

INTEGRAL POWER SUPPLY



Model 2718A mounted in Model 4992A Rack Enclosure together with a Model 2954A Peak Holding Meter and a Model 14718 Blank Panel.



Model 2718A in a Model 2991A Carrying Case.

ELECTRICAL SPECIFICATIONS

INPUT CHARACTERISTICS

Input Connection	The input is single-ended with one side connected to circuit ground.
Allowable Source Impedance	Operates satisfactorily with as little as 50 MΩ of source resistance. The input is restricted to capacitance devices.
Source Capacitance	All specifications are met with source capacitance up to 10,000 pF on the first two full scale ranges; up to 100,000 pF, on the third and higher ranges. With higher capacitances, the amplifier operates satisfactorily, but noise increases and gain decreases slightly.
Overload Recovery Time	Instantaneous for a 1 millisecond square pulse fo 5500 pC amplitude at the input on the lowest two full scale range positions, and 55,000 pC at all higher positions.

OUTPUT CHARACTERISTICS

Output Connection	The output is single-ended with one side connected to circuit ground.
Output Impedance	
Signal Output	50Ω, maximum
Power Amplifier	1.5Ω, maximum
Maximum Linear Output Voltage	±5.0 V pk, full scale (30 kHz or less)
Maximum Linear Output Current	
Signal Output	±1.0 mA pk
Power Amplifier	±85 mA pk. Current limited at ±100 mA maximum, with load resistance of 30 or greater, to protect galvanometers.
Residual Noise	Less than the total of 0.015 rms pC plus 0.005 rms pC per 1000 pF of source capacitance referred to the input, or 2.5 rms mV referred to the output, whichever is greater.

TRANSFER CHARACTERISTICS

Gain Ranges	System gain is adjustable to allow calibrated full scale output of ±5 V pk in six ranges.
Transducer Sensitivity	**Full Scale**
0.1 to 1.0 pC/g	250, 500, 2500, 5000, 25,000 and 50,000 pk g (red)
1.0 to 10 pC/g	25, 50, 250, 500, 2500 and 5000 pk g (black)
10 to 100 pC/g	2.5, 5.0, 25, 50, 250 and 500 pk g (not shown)
System Accuracy	±1.5% of full scale on any range, at room temperature, and 3500 pF source capacitance or less.
Gain Stability	Better than 1% for rated source capacitance; better than 0.25% for line voltage variations between 105 and 125 VAC; better than ±2% with time and temperature.
Power Amplifier Output Range	Variable between 0.1 and 1.0 times the signal output.
Frequency Response, With Selectable Low Frequency Cutoff	
.03 Hz:	±5%, 0.1 Hz to 30 kHz; +1/−3 db, .03 Hz to 100 kHz
.3 Hz:	±5%, 1.0 Hz to 30 kHz; +1/−3 db, .3 Hz to 100 kHz
.7 Hz:	±5%, 2.0 Hz to 30 kHz; +1/−3 db, .7 Hz to 100 kHz
With Selectable Low Pass Filters	
330 Hz:	±5% to 100 Hz; −3 db at 330 Hz, 6 db/octave
3300 Hz:	±5% to 1000 Hz; −3 db at 3300 Hz, 6 db/octave
13,200 Hz:	±5% to 4000 Hz; −3 db at 13,200 Hz; 6 db/octave
Harmonic Distortion	1% maximum
Linearity	±1% of reading from best straight line approximation to the curve of output amplitude versus input amplitude.
Warmup Time	30 minutes to meet all specifications.
Calibration	Calibration signal provided at amplifier input results in a 5.0 V pk-pk (one half full scale) sine wave at Signal Output regardless of range or sensitivity setting. Amplitude accuracy is ±1%. Nominal frequency is 1000 Hz.

POWER

Line Voltage	105 to 125 VAC, 50 to 400 Hz (210 to 250 VAC optional, specify 2718AV)
Line Current	Approximately 0.25 A per channel
Line Transient Sensitivity	With maximum system gain, transient at the output due to a line transient is less than 5 mV/V.

PHYSICAL SPECIFICATIONS

Dimensions	Model 2718A in Model 4992A Rack Adapter: 7″ high x 19″ wide x 10″ deep, exclusive of controls and connectors. Model 2718A in Model 2991A Carrying Case: 7¼″ high x 6″ wide x 11⅜″ deep, exclusive of controls. Model 2718A in Model 2992A Dual Carrying Case: 7¼″ high x 11½″ wide x 11⅜″ deep, exclusive of controls.
Weight (nominal)	Model 2718A, 6½ lbs. Model 2991A, 3 lbs. Model 2992A, 4¾ lbs. Model 2954A, 2¼ lbs. Model 4992A, 7 lbs.
Finish	Grey Enamel, Federal Standard 595, Color No. 26595.
Connectors (on rear of chassis)	
Input	Microdot S-50 Series, coaxial receptacle, 10-32 thread, or equivalent. BNC type available, add suffix T to part number.
Signal Output	BNC, UG-1094/U, or equivalent.
Galvanometer Output	Switchcraft B3M, or equivalent. Mating Connector, Cannon XLR-3-11C, supplied.
Power Transformer Shield	Binding Post
Power Input	Hubbel No. 7486, or equivalent
Peak Holding Meter	Cannon WK-5-32S, or equivalent
External Filter	Switchcraft No. 13B Jack. Mating Connector, Switchcraft No. 267, not supplied.
Controls (on front panel)	
Power	Push button, on-off switch
Zero	Screwdriver adjustable potentiometer
Low Frequency Cutoff	Three position rotary switch
Calibration	Two position toggle switch
Full Scale Range	Six position rotary switch
Sensitivity	Ten turn potentiometer
Galvo Adjust	Single turn, screwdriver adjustable potentiometer
Filter Selector	Four position rotary switch
Reset	Push button switch
Accessories Supplied	Model 2910-4, five foot Power Cord Assembly; output mating connectors; mounting hardware.

ENVIRONMENTAL SPECIFICATIONS

Temperature	
Operating	+40°F to +125°F (+5°C to +52°C)
Non-Operating	−65°F to +185°F (−54°C to +85°C)
Humidity	95% Relative Humidity

PRICES

2718A Configuration	Consisting Of						Combination Price
	2718A Amplifier Module	2991A Portable Case	2992A Dual Case	4992A Rack Mount	2954A Peak Holding Meter	14718 Blank Panel	
Price Each	$725.00	$95.00	$125.00	$135.00	$225.00	$15.00	
2718A in Portable Carrying Case	1	1	---	---	---	---	$ 820.00
Two 2718A in Dual Carrying Case	2	---	1	---	---	---	$1,575.00
Portable 2718A with Peak Holding Meter	1	---	1	---	1	---	$1,075.00
Rack Mounted 2718A with Peak Holding Meter	1	---	---	1	1	1	$1,100.00
One 2718A in 19" Rack	1	---	---	1	---	2	$ 890.00
Two 2718A in 19" Rack	2	---	---	1	---	1	$1,600.00
Three 2718A in 19" Rack	3	---	---	1	---	---	$2,310.00

ACCESSORIES AND OPTIONS

BNC Input Connector (add suffix "T")	No additional charge
230 Volt AC Operation (add suffix "V")	No additional charge
Triple Power Cord Assembly P/N 14786 (for three 2718A modules in a 4992A rack)	$27.00 each

Prices are F.O.B. Pasadena, California. Your Endevco Field Engineer is qualified to advise you regarding changes in printed information.

Prices of ENDEVCO® products to be exported or purchased with intent to export beyond the territorial limits of the United States and Canada are subject to special quotation.

Continued product improvement necessitates that Endevco reserve the right to modify these specifications and/or prices without notice.

RELIABILITY: Endevco maintains a program of contant surveillance over all products to ensure a high level of reliability. This program includes attention to reliability factors during product design, the support of stringent quality control requirements, and compulsory corrective action procedures. These features, together with conservative specifications, have made the name Endevco synonymous with reliability.

ENDEVCO® ACCELEROMETERS FOR SHOCK MEASUREMENT

Model 2221E	to 2000 g, high sensitivity, for medium duration shock pulses, center mounting hole for ease of attachment.
Model 2252	to 5000 g. for shock pulses with durations greater than 30 milliseconds, for cryogenic environments, stud mounting.
Model 2291	to 100,000 g, low mass, for very short shock pulses.
Model 2292	to 20,000 g, low mass, for very short shock pulses.

ENDEVCO DYNAMIC INSTRUMENT DIVISION
801 S. ARROYO PARKWAY • PASADENA, CALIF. 91109 • PHONE (213) 795-0271

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INSTRUCTION MANUAL
MODEL 2718A SHOCK AMPLIFIER

1.0 INTRODUCTION

1.1 General Description

The Model 2718A Shock Amplifier is a charge amplifier designed specifically to meet the signal conditioning requirements of shock measurement. The wide frequency range and dynamic range of the amplifier permits accurate measurement of wide variety of shock pulses — from rapid rise times to long durations. It is also suitable for measuring random and sinusoidal vibration.

The Model 2718A Shock Amplifier Module contains a regulated power supply, charge converter, capacitance coupled voltage amplifier, filters, calibration oscillator, and a power amplifier.

Charge amplifiers sense charge at the input and produce a voltage output directly proportional to the input charge. This permits the use of long cable without attenuation effects. Signal cables may be changed without requiring system recalibration. Low frequency response is independent of transducer and cable capacitance.

The Model 2718A's modular design allows it, and its associated accessories, to be mounted in a number of configurations. The Model 2718A can be housed in a portable carrying case (Model 2991A or 2992A), or in a 19" rack (Model 4992A) with one, two or three amplifiers per rack.

A Peak Holding Meter, Model 2954A, is available for use with the Model 2718A to indicate the maximum amplitude of a pulse or a series of pulses from any piezoelectric transducer. It permits the operator to visually determine the pulse amplitude. The Model 2954A can be mounted in a portable configuration or in a rack with the Model 2718A.

1.2 Input Devices

The input of the amplifier is restricted to the use of capacitive devices. The maximum allowable source (shunt) capacitance, to meet all specifications, is 10,000 pF on the first two ranges and 100,000 pF on the higher ranges. The input resistance should exceed 50 megohms for all L.F. Switch positions.

1.3 Output Devices

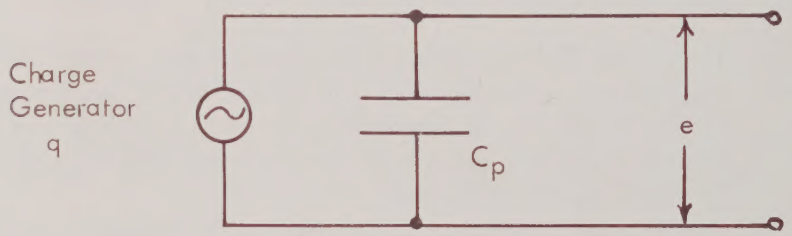
1.3.1 Signal Output - The Signal Output may be connected to any resistive load providing that the Maximum Linear Output Current is not exceeded. The maximum Signal Output current is ±1.0 mA pk.

1.3.2 Power Amplifier - The Galvanometer Output may be connected to any resistive load of 30 ohms or greater, such as galvanometers. (These include high frequency galvanometers having a maximum safe current of 100 mA).

2.0 THEORY

2.1 Charge Generators

The simplified equivalent circuit of a piezoelectric or capacitive transducer is shown in Figure 1. In an accelerometer, the charge generated is directly proportional to acceleration, and for a given acceleration the peak charge remains constant regardless of the amount of external capacitance added to the transducer. The open circuit voltage (e) is equal to the charge (q) divided by the transducer capacitance (C_p), or $e = q/C_p$.



Equivalent Circuit

FIGURE 1.

All new ENDEVCO® Accelerometers have the charge sensitivity provided on the calibration card, expressed in peak picocoulombs per peak g.

For other transducers the charge sensitivity may be calculated from the following formula:

$$Q = \frac{E_{cal}\,(C_p + C_{cal})}{1000}$$

Where:

Q = charge sensitivity in pk pC/pk g (= pC/g)

E_{cal} = factory supplied voltage sensitivity expressed in pk mV/pk g (= mV/g)

C_p = internal capacitance of transducer in picofarads

C_{cal} = external cable and amplifier capacitance in picofarads when calibrated

2.1 Charge Generators (continued)

The values of E_{cal}, C_p, and C_{cal} are usually given on the calibration card. Since the charge sensitivity is not affected by additional capacitance, such as long cables and amplifier input capacitance, no additional sensitivity calculations are required.

For example, the nominal voltage sensitivity (E_{cal}) of the ENDEVCO® Model 2252 Accelerometer is 5 pk mV/pk g, nominal capacitance (C_p) is 100 pF, and the external capacitance when calibrated (C_{cal}) is 300 pF. Thus, the nominal charge sensitivity:

$$Q = \frac{5\ (100 + 300)}{1000} = 2 \text{ pk pC/pk g}$$

2.2 Charge Conversion

The Model 2718 accepts the instantaneous charge from the transducer and converts it to a voltage directly proportional to the input charge. Although the gain of the amplifier may be expressed as millivolts output per picocoulombs input, this need not be considered in actual applications. The Model 2718 provides a sensitivity dial with which a known output voltage is obtained for transducer charge sensitivities of .1 to 10 pC/g and full scale g levels as indicated.

2.3 Frequency Response for Shock Measurement

Transient measurements should be made with instruments which have a flat frequency response over a wide range. Not only must the transducer response be considered, but the amplifier and all associated readout devices must be capable of passing, without distortion, all the frequency components contained in the transient. When the low cutoff frequency of an amplifier (response down 3 db or 30%) is known, then the maximum pulse width which the amplifier will pass with known accuracy may be calculated as follows:

	T_m Maximum Pulse Width	
	2% Accuracy	5% Accuracy
Half sine or sawtooth pulse	$\frac{.01}{f_c}$	$\frac{.02}{f_c}$
Square wave pulse	$\frac{.003}{f_c}$	$\frac{.008}{f_c}$

Where: f_c = low cutoff frequency

T_m = maximum pulse width in seconds

2.3 Frequency Response for Shock Measurement (continued)

For example:

The Model 2718A provides three cutoff frequencies of 0.03, 0.3 and 0.7 Hz. The maximum half sine pulse width which may be measured with 5% accuracy, and at a low cutoff frequency of 0.03 Hz is

$$T_m = \frac{.02}{f_c} = \frac{.02}{.03} = 660 \text{ msec}$$

The above calculations apply to the Model 2718A or any other amplifier which has a first order rolloff.

3.0 EXTERNAL CONTROLS AND CONNECTORS

3.1 Front Panel

3.1.1 Power Switch and Light - The Power Switch is a single pole, push button switch which applies AC power to the amplifier. The pilot light, to the right of the switch, indicates when the amplifier is energized.

2.1.2 Low Frequency Cutoff - The Low Frequency Cutoff Switch, S1, is a three-position rotary switch which changes the low frequency cutoff (down 3 db at 0.03, 0.3, or 0.7 Hz).

3.1.3 High Frequency Cutoff - The High Frequency Cutoff switch is a four-position rotary switch which allows the selection of one of the three internal low pass filters.

3.1.4 Calibration - The Calibration Switch, S4, is a two-position toggle switch which is used to switch, in or out, the internal calibration signal.

3.1.5 Full Scale - The Full Scale Selector, S3, is a six-position rotary switch which selects the Full Scale g, or psi, or pound ranges. The two sets of ranges, red and black, are directly related to the two ranges of charge sensitivities, red and black, on the Sensitivity Dial below. The numerals of one color only should be used in any measurement. For example, if the transducer sensitivity is in the range of .1 to 1 pC/g (red), the full scale ranges which apply are shown in red.

3.1.6 Zero - The Zero Adjust is a screwdriver adjusted, multiturn potentiometer used to balance the output amplifier.

3.1.7 Galvanometer Adjust - The Galvanometer Adjust is a single-turn potentiometer which adjusts the gain of the Power Amplifier.

3.1.8 pC/g Sensitivity Dial - The Sensitivity Control, R59, is a ten-turn potentiometer which calibrates the Model 2718A Amplifier for specific transducer charge sensitivities expressed in picocoulombs per g or psi or pound. The number on the outer dial, in the window, represents the first significant digit; the second and third significant digits are indicated on the inner dial under the vertical line. The black and red ranges above the dial are directly related to the black and red numerals above the Full Scale Switch and only numerals of one color should be used in any measurement. A lock is also provided so that the pot may be held in any desired position. CAUTION: The counter-clockwise stop position of the dial is at 1.00. Do not attempt to turn the pot below 1.00.

3.1.9 Reset - A Reset Button, S5, is provided to reset the output signal to its steady state DC level, and enables the 2718A to be clear and ready for any incoming signals. Resetting of the output DC voltage may be necessary after changing full scale ranges, or large transients have been applied to the input of the amplifier.

3.2 Rear Panel

3.2.1 Input Connector - The Input Connector, J1, is a coaxial connector, Microdot S-50 Series or equivalent, with the shell insulated from the chassis, but connected to circuit and chassis ground.

3.2.2 Galvanometer Output - The Galvanometer Output Connector, J2, is a three-terminal connector. It mates with a Cannon XLR-3-11C connector. Pin 1 is the signal output, Pin 2 is the circuit ground, and Pin 3 is the chassis ground.

3.2.3 Signal Output - The Signal Output Connector, J3, is a coaxial connector with its shell insulated from the chassis, but connected to circuit and chassis ground. It mates with a Type BNC, UG-1094/U or equivalent.

3.2.4 External Filter Jack - The External Filter Jack is a microphone type jack, Switchcraft No. 13B, which allows an external filter to be substituted for the internal low pass filters. The High Frequency Cutoff switch must be in the out position. The mating plug, Switchcraft No. 267, is not supplied.

3.2.5 Fuse - A fuse, Littelfuse No. 313.750 or equivalent, 125 V, 3/4A, Slo-Blo, is connected in series with one side of the power line. For 230 V operation a Fusetron MDL or equivalent 3/8 A, is connected in series with one side of the power line.

3.2.6 Power Cord Receptacle - Connector, J6, Hubbel No. 7486, 3 pin "Twist-Lok" or equivalent, mates with Model 2910-4 Power Cord Assembly, a 5-1/2 foot, three-wire cable with standard three-prong plug. For 230 V operation, the male plug on the Power Cord Assembly is removed and the wires at the end of the cable are stripped and tinned.

3.2.7 Binding Post - The G.R. Binding Post is suitable for connection of a Banana Plug, Spade Lug or Wire. The binding post is connected to the electrostatic shield of the power transformer to reduce line transient effects.

3.2.8 Peak Meter Receptacle - This receptacle is a Cannon WK-5-32S connector which provides signal and power for the Model 2954A Peak Holding Meter. Use the Model 15438 Cable Assembly to interconnect the Models 2718A and 2954A.

4.0 INITIAL SETUP AND CHECKOUT

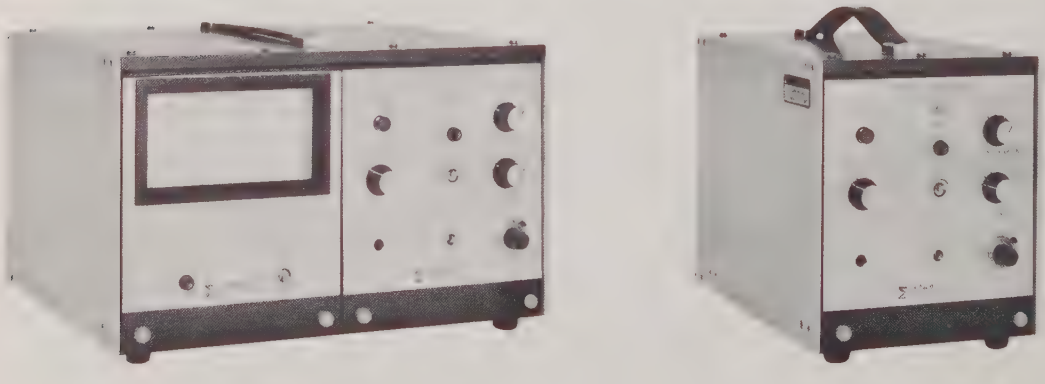
4.1 Unpacking and Inspection

This equipment has been thoroughly inspected and tested at the factory and should be ready for operation when received. However, the customer should make an inspection to be certain that no damage has occurred during shipment.

Carefully remove the instrument from its packing box. Inspect case and front panel for any indication of damage during shipping and handling.

4.2 Mounting Procedure

The Model 2718A and its associated accessories can be mounted in a rack or the 2718A can be mounted in a portable carrying case with mechanical ease. The view in Figure 2 shows the portable configuration, and in Figure 3, the rack mount configuration.



2992A 2991A

FIGURE 2.

Model 2718A in Model 2991A and 2992A Portable Carrying Cases

4.2 Mounting Procedure (continued)

The Model 2718A and Model 2954A Modules can be easily mounted in either the Model 4992A Rack, or the Model 2991A or 2992A Carrying Case, by tightening the two captive thumb screws on the front panel of the 2718A or 2954A, and inserting the two Phillips screws through the rear skirt of the 4992A, 2991A or 2992A.

FIGURE 3.

Model 2718A Amplifier Module, Model 2954A Peak Holding Meter and Model 14718 Blank Panel in Model 4992A Rack

4.3 Initial Checkout

Before the instrument is put into operation, an initial checkout should be made to ensure that everything is operating satisfactorily. The following procedure should be followd:

4.3 Initial Checkout (continued)

Equipment Needed:

Oscillator, H.P. 200CD or equivalent
Attenuator, 1 kΩ multi-turn potentiometer
Capacitor, in a shield, 1000 pF ±1%
Oscilloscope, Tektronix 531A or equivalent
AC VTVM, H.P. 400D or equivalent

4.3.1 Initial Connections and Control Settings - Connect amplifier and associated equipment as shown in Figure 4.

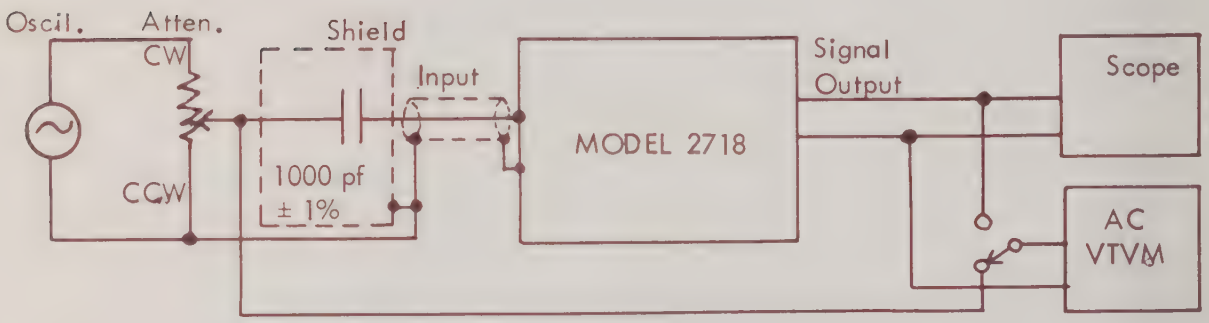


FIGURE 4.

Control Setting:

Set front panel controls as follows:

L. F. Cutoff	0.7 Hz
H. F. Filter	Out
Calib.-Operate	Operate
Full Scale g	25 (Black)
pC/g	1.0 (Black)

Turn on power by pushing power switch. Pilot light should go on indicating that the instrument is on. Allow thirty minutes warmup before starting checkout.

4.3.2 Zero Check

The DC voltages at the output of the charge converter and voltage amplifier sections are not critical. These circuits are capacitance coupled and the DC voltages may vary over a relatively wide range without affecting the usefulness or accuracy of the charge amplifier. If clipping is observed, then zero adjustment is necessary. Zero adjustment procedures are given in Section 7.3.

4.3.3 Full Scale Range Check

4.3.3.1 Apply a 1000 Hz, 17.7 mV rms (25 mV pk) sinusoidal signal to the amplifier through the 1000 pF capacitor. Note the output on the scope and VTVM. The wave shape should be undistorted and the output voltage should be 3.53 V rms (5.0 V pk) ±1.5%.

CAUTION: VTVM should be accurate to within ±0.5%.

4.3.3.2 Switch the full scale g control to 50 g (black) and increase the input signal to 35.3 mV (50 mV peak). Again the output should be undistorted and 3.53 V rms (5.0 V pk) ±1.5%.

4.3.3.3 Repeat procedure for each of the ranges changing the input signal appropriately. Output voltages should always be 3.53 V rms (5.0 V pk) ±1.5%.

NOTE: The input peak millivolt signal required to achieve full scale output is equal to the product of the pC/g dial reading and the full scale g range, using numerals of one color.

4.3.4 pC/g Dial Check - With the full scale g control set to 250 g (black) adjust the input voltage until the output is 3.50 V rms. Turn the pC/g dial from 1.0 to 10.00 and change the full scale g control to 25 g (black). The output voltage should be 3.50 V rms ±1.5%.

4.3.5 Residual Noise - Again set all controls as specified in Section 4.3.1. Reduce input signal to zero by turning down the oscillator and running the attenuator to its counterclockwise end. On the meter, observe the residual noise. The signal should be less than 5 rms mV.

4.3.6 Calibration Check - Set controls as specified in Section 4.3.1. Set "Calib-Operate" Switch to Calib. Note the output on a calibrated scope. The output should be sine wave with a peak-to-peak amplitude of 5.0 V ±2%. Switch the Full Scale g control through its six positions. The calibration output should remain 5.0 V pk/pk ±2%.

4.3.7 Power Amplifier and Galvanometer Adjust Check

4.3.7.1 Change the scope and VTVM from the Signal Output to the Galvanometer Output connector.

4.3.7.2 Set front panel controls as specified in Section 4.3.1. Apply a 1000 Hz, 17.7 mV rms (25 mV pk) signal to the input through the 1000 pF capacitor. Note the output on the scope and VTVM. Vary the "Galv Adjust" control from its fully clockwise position to its fully counterclockwise position. The output voltage should vary from greater than 3.53 V rms (5 V pk) to less than 353 mV rms (500 mV pk).

4.3.7.3 Load galvanometer output with 50.0 Ω resistance. Increase "Galv Adjust" from its counterclockwise position, observing the output wave shape on the scope. The output should be undistorted to at least 3.0 V rms (4.25 V pk) and should limit at 10.0 V pk/pk or less.

5.0 OPERATING INSTRUCTIONS

5.1 Power

The Model 2718A should be operated from line source of 105 to 125 VAC, 50, 60, or 400 Hz. The line cord includes a third wire connecting the chassis to power ground.

5.2 Sensitivity

The nominal sensitivity of the amplifier is such that with the Full Scale Control at 25 (black) and the Sensitivity Control Dial at 1.00 (CCW), a 25 pk pC input signal will give full scale output. Full scale output is defined as 5 V pk at the Signal Output, with no load.

NOTE: There is a 180° phase shift (signal inversion) between input and output signals at the Signal Output connector.

The amplifier has a precision attenuator (Full Scale Control) which provides two sets of six full scale ranges. Full scale output is obtained for various transducer sensitivities and full scale input levels as follows:

5.2 Sensitivity (continued)

Full Scale Input to Obtain Full Scale Output

Scale Color	Red	Black		
Transducer Sensitivity	0.1 to 1.0 pC/g	1.0 to 10 pC/g	10 to 100 pC/g	100 to 1000 pC/g
Full Scale Input	250 g 500 g 2500 g 5000 g 25,000 g 50,000 g	25 g 50 g 250 g 500 g 2500 g 5000 g	2.5 g 5.0 g 25 g 50 g 250 g 500 g	.25 g .50 g 2.5 g 5.0 g 25 g 50 g

The input signal, in peak picocoulombs required to achieve full scale output, 5 V pk at the Signal Output Connector, is equal to the product of the decade dial setting and the Full Scale Range, using only the numerals of one color.

The maximum charge gain of the amplifier is obtained when the Sensitivity Dial is turned to its counterclockwise stop position, at 1.00. Minimum gain is obtained in clockwise stop position.

5.3 Internal Calibration

An internal oscillator provides a calibration source in the Model 2718. This source supplies a calibration charge to the input of the amplifier such that its peak-to-peak value represents the peak full scale input as noted on the Full Scale range switch, regardless of range or sensitivity dial setting. The frequency of the calibration signal is 1000 Hz, nominal.

The rated full scale output of the amplifier is 5 V pk or 10 V pk/pk. The output of the amplifier with the Calibration Switch in the "Calib" position is a 2.5 V pk sine wave (equal to one-half full scale output). An oscilloscope connected to the Signal Output, or a galvanometer connected to the Galvo Output will be deflected to plus and minus one-half peak full scale.

5.4 Low Frequency Cutoff

The setting of the Low Frequency Cutoff Switch will determine the maximum width of a pulse which will be accurately reproduced by the amplifier, as discussed in Section 2.3. However, some synthetic piezoelectric crystals

5.4 Low Frequency Cutoff (continued)

exhibit temperature effects which appear as low frequency drift or wander. This temperature effect may be reduced considerably by operating the Model 2718A at the higher (low) cutoff frequencies, 0.3 Hz or 0.7 Hz, since this pyroelectric effect is a low frequency phenomenon.

Many ENDEVCO® Transducers, those utilizing Piezite® P-2 crystal material, exhibit little or no temperature effects. Thus, the amplifier may be operated at a 0.03 Hz low frequency cutoff without distortion of the signal. Accelerometer Model 2242C and 2252 are recommended for long pulse shock measurements up to 1000 g and 5000 g respectively.

5.5 High Frequency Filters

Shock machines will often ring at high frequencies during or after shock. Also, a pulse with fast rise time may excite the natural resonant frequency of accelerometers. It may be desireable to filter out these frequencies to permit recording or observation of the pulse wave shape.

The Model 2718A includes three low pass filters, which may be selected by the switch on the front panel. The filters have the following characteristics:

± 5% Response	Down 3 db or greater, at
0 to 100 Hz	330 Hz ± 10%
0 to 1000 Hz	3300 Hz ± 10%
0 to 4000 Hz	13,200 Hz ± 10%

An external filter may be connected into the circuit through the phone jack, J8, on the rear of the amplifier. A three-terminal phone plug, Switchcraft No. 267 or equal, will mate with this jack. The external filter must have input and output impedances which will allow it to operate correctly with the internal impedances of the amplifier as shown in Figure 5.

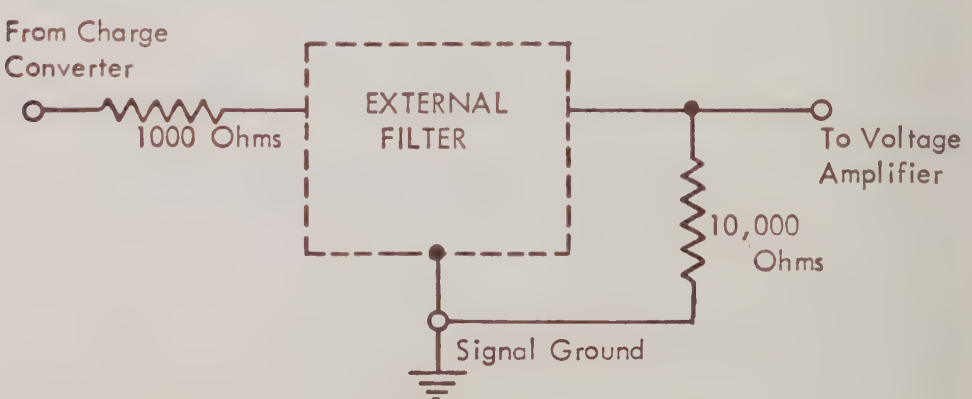


FIGURE 5.

Connections for External Filter

5.5 High Frequency Filters (continued)

If the transmissibility of the external filter is not unity, an appropriate correction factor must be applied to the data signal. Note that the internal sinusoidal calibration signal has a frequency of approximately 1000 Hz and will be attenuated by the internal, and possibly the external, filter.

5.6 Power Amplifier

The Model 2718A Charge Amplifier is capable of delivering a linear output current up to 85 pk mA, for high frequency galvanometers or long out cables. The gain of the power amplifier is variable by means of a screwdriver adjustable pot on the front panel from less than 0.1 to greater than 1.0 without affecting the system sensitivity prior to the power amplifier.

The signal at the Galvo Output connector is in phase with the input signal.

5.7 Zero Adjust

The front panel zero adjust is used to set the dc voltage at the signal output to zero with no signal applied to the input. The zero adjust is a screwdriver adjustable potentiometer. Since the Charge Converter and Voltage Amplifier are capacitance coupled, the Charge Converter DC level should have very little effect on the Voltage Amplifier and, under usual conditions, should not be touched except when "clipping" due to the Charge Converter operating point is experienced. For further information see Section 7.3.

5.8 Grounding

The circuit ground is grounded to the chassis at one and only one point to prevent possible ground loops. If excessive noise, particularly at power line frequency, appears at the output, it may be necessary to insulate the transducer from the structure and/or insulate the ground circuit of the readout device.

The electrostatic shield in the power transformer is connected to a binding post in the rear of the 2718A. A ground can be established at this point to reduce any line transient effects. However, a good earth ground should be used or the binding post should not be grounded at all.

5.9 Using the Model 2718A to Monitor Peak G's or Other Units

To set up the 2718A to monitor peak g's, the following procedure is used:

1. Note from the calibration card supplied with the transducer the charge sensitivity as expressed in picocoulombs per g. Since the charge generated per unit remains constant regardless of the amount of external capacitance added to the transducer, no additional calculations need be made.

5.9 Using the Model 2718A to Monitor Peak G's or Other Units (continued)

2. Adjust the pC/g decade dial to the sensitivity as obtained above. (See Sections 3.1.8 and 5.2.)
3. Set the "Full Scale g" switch to the desired range.
4. Set the Low Frequency Cutoff switch to the desired frequency. (See Sections 2.3 and 5.4.)
5. Set the High Frequency Cutoff to the desired condition. (See Section 5.5.)
6. Turn on power and allow the amplifier to warm up for at least 30 minutes.
7. Throw the Calibrate Switch on to obtain a 5 V pk/pk output signal representing the magnitude of the peak g level set at the Full Scale control. Adjust the readout device as desired and then switch out the calibration signal.
8. Depress and release the Reset button repeatedly until the dc level at the output connector is stable.

The system is now calibrated directly in g, pounds, psi, etc.

For example: Assume a Model 2252 Accelerometer (Charge Sensitivity 2.0 pk pC/pk g) is to be used to monitor a 4000 g, 500 μsecond shock. Set into the Sensitivity Dial the value 2.0. Since the accelerometer sensitivity lies between 1.0 and 10, refer to the black numerals. Set the Full Scale control to 5000 g (black). Since the anticipated pulse width is short, the Low Frequency Cutoff Switch may be left in 0.7 Hz position.

Throw the Calibrate Switch to "Calib." The 5 V pk/pk signal represents a zero to peak 5000 g signal. Adjust the output device to a multiple of 5 division. Throw the Calibrate Switch to Operate. The system is now calibrated to read directly in peak g with 5 V pk output from the Model 2718A representing 5000 g.

For a transducer sensitivity greater than 10.0 pC/g, set the multiturn dial to 1/10 the transducer sensitivity (black) and turn the Full Scale selector to 10 times the desired full scale range (black). The full scale value shown in black must be multiplied by .1 to obtain the actual full scale value.

For a transducer sensitivity less than 0.1 pC/g, set the multiturn dial to 10 times the transducer sensitivity (red) and turn the Full Scale Selector to 1/10 the desired full scale range (red). The full scale value shown in red must be multiplied by 10 to obtain the actual full scale value.

5.10 Using Long Input Cables

The maximum allowable source capacitance to meet all specification requirements is 10,000 pF on the first two ranges and 100,000 pF on the

5.10 Using Long Input Cables (continued)

third and higher ranges. Source capacitance includes both transducer and input cable capacitance. A source capacitance greater than these values will result in increased residual noise, some loss of gain in the amplifier, and lower high frequency response.

If the Model 2718A is used with transducers utilizing P-2 crystal material, internal capacitance nominally 100 pF, over 3000 feet of cable, at 30 pF per foot, may be connected between the amplifier and the transducer.

6.0 CIRCUIT DESCRIPTION

The Model 2718 is made up of (1) a charge converter, (2) a capacitance coupled voltage amplifier, (3) power amplifier, (4) a calibrator, and (5) a regulated power supply. Refer to Schematic Drawing 2718A-501C.

6.1 Charge Converter

The function of the charge converter is to sense the charge being applied at the input of the amplifier and convert the charge into a voltage. The charge gain is either 2 or 0.2 mV/pC, depending on the full scale g range.

The charge converter consists of a high gain amplifier made up of Q1, Q2, Q3, Q4, Q5 and Q6 and a capacitance feedback circuit from the output to the input. Two different feedback capacitors are used depending on the gain setting. Capacitor C1 is in the circuit when the gain is 2.0 mV/pC, while C2 is in the circuit when the gain is 0.2 mV/pC.

The low frequency time constant of the charge converter is determined by resistors R2, R3, R14, R15 and R16. One or more of these resistors is connected in parallel with the feedback capacitor depending on the position of the low frequency cutoff switch, the low frequency time constant of the charge converter being equal to the product of the feedback capacitor and its parallel resistance. In this type of circuit the capacity of the input transducer has no effect on the time constant of the system.

The charge converter is capacitance coupled to the voltage amplifier to prevent DC drift. The bias of the F.E.T. (Q1) is adjustable through potentiometer R7 which sets the DC level of the charge converter. This adjustment screw is located inside the 2718 Module and normally should not be changed from the factory setting.

From the output of the charge converter the signal is fed through the voltage amplifier coupling capacitor, C12, to the filter receptacle and then to the attenuator. The attenuator in conjunction with the two feedback capacitors, C1 and C2, sets the range of the amplifier as required, and consists of resistors R34 through R40 and switch S3. If

a spurious or unwanted signal charges the coupling capacitor, C12, the DC level can be quickly returned to zero by pressing the reset button, S5, on the 2718 front panel.

6.2 Voltage Amplifier

This amplifier contains most of the voltage gain of the system. It also contains a gain control potentiometer, R59, which is used to calibrate the system for specific transducer sensitivities. Q7, Q8, Q9, Q10, and Q11 make up the voltage amplifier. Q8 is a dual transistor in a single case which reduces zero drift with temperature. Negative feedback is connected from the output to one base of Q7. This negative feedback sets the gain of the voltage amplifier. A dial is attached to the potentiometer, R59, which is set to read directly in transducer sensitivity (pC/g) by the adjustment of R58 and R62.

Potentiometer R46 is the DC balance control for the amplifier and is available on the front panel for setting the zero.

6.3 Power Amplifier

The power amplifier has a gain adjustable from 0.1 to 1.0 and provides current for driving a high frequency galvanometer or long lines. Provision is made in the circuit to limit the output current to a predetermined value (approximately ±100 mA). Q201 provides the voltage gain for the power amplifier, while Q202, Q203, Q204, Q205 and Q208 provide current gain. Negative feedback is connected between the output and the input for stability and gain adjustment. Gain adjustment for the power amplifier is provided by potentiometer R205 located on the front panel.

Resistors R213 through R216 along with diodes CR202, CR203, CR204 and CR205 and transistors Q206 and Q207 make up the current limiting circuit. The diodes bias Q206 and Q207 on until such time as the output current causes a voltage drop across R215 and R216 to shut the transistor off. This limits the current essentially independent of the voltage output.

6.4 Calibrator

The calibrator circuit supplies a sine wave signal to the input of the charge converter to calibrate the system. The calibrator consists of a free running oscillator, made up of R33 through R39, L3, R50 through R54, C15, C16, C17, CR12 and CR13, and Q11 through Q14.

The oscillator is turned on by switch S4. This is the Calib-Operate Switch on the front panel.

The output of the oscillator is fed through C18 to an attenuator, R40 through R42 and R63 through R69. This attenuator is ganged to the full scale of range switch so the output from the attenuator is inversely proportional to the gain of the system. The calibration signal is fed from the attenuator through C3 to the input of the charge converter.

6.4 Calibrator (continued)

Ganged to S4 is an additional switch which sets the direct coupled amplifier to a fixed gain regardless of the setting of the sensitivity control. In this way, a constant voltage appears at the output regardless of range or sensitivity setting. The peak-to-peak voltage represents the full scale g's as indicated on the full scale g control.

6.5 Power Supply

The power supply provides regulated plus and minus 30 volts DC to the amplifier sections and the calibrator, and a plus and minus 10 volts DC to the power amplifier.

The power supply consists of a power transformer, T101, a rectifier circuit, CR117 through CR120 and plus and minus regulator circuits. The two regulator circuits are identical except for transistor type changes to substitute NPN for PNP transistors. The following circuit description applies to both regulators even though it describes the +30 volts regulator only.

A portion of the output voltage is applied to the base of Q103 through attenuators R115, R116 and R117. This voltage is compared to a reference voltage which is applied to the base of Q101. Any error signal is amplified by Q101 and Q105 and fed to the base of Q111 which is an emitter follower which drives the series regulating transistor Q109, thereby correcting the output voltage.

The plus and minus 10 volts DC for use with the power amplifier is obtained from the power transformer, T101, a rectifier circuit, CR127 through CR130 and the Zener diodes, CR125 and CR126. It is regulated by referencing to the regulated 30 volts DC supply and clamping with the Zener diodes CR125 and CR126.

7.0 MAINTENANCE AND TROUBLE SHOOTING

7.1 Maintenance

Very little routine maintenance is normally required. A little preventive maintenance directed toward keeping the equipment in proper adjustment will, however, go far toward assuring trouble-free operation when the equipment is needed.

All external connectors should be checked periodically for loose connections, shorts or grounds.

7.1 Maintenance (continued)

The calibration signal level and zero adjustments should be checked periodically using the procedure outlined below:

7.2 Power Supply Voltage Adjustment

The power supply voltages are not critical and normally do not require adjustment. If adjustment of power supply voltages is necessary, proceed as follows:

7.2.1 30 volt DC Supply - Turn on power and allow one hour for warmup. Adjust the input of the power supply to 115 VAC.

Measure the plus and minus 30 VDC at the emitters of Q109 and Q110, respectively. If these are not 30.0 V ±300 mV DC, adjust R116 and/or R119 until the voltages are within limits.

7.2.2 10 volt DC Supply - Measure the plus and minus 10 VDC at the emitters of Q119 and Q120, respectively. The supply voltages should be +10 volts, +1, -3 VDC and -10 volts, -1, +3 VDC. If these are not within specification limits, locate and replace the faulty component in the supply.

7.3 Zero Adjustment

There are three zero adjustments on the 2718 Charge Amplifier. One is the voltage amplifier zero control on the front panel (R46), the second is a trimpot (R7) in the charge converter circuit, and the third zero adjust (R206) is located in the power amplifier circuit.

The DC voltages at the output of the charge converter and voltage amplifier sections are not critical. These circuits are capacitance coupled and the DC voltage may vary over a wide range without affecting the usefulness or accuracy of the charge amplifier. Adjustment of zero may be required if a full scale output cannot be obtained without clipping. The Power Amplifier DC output voltage need not be adjusted unless the galvanometer connected to the Charge Amplifier cannot mechanically be set to the desired position.

To readjust the zero:

7.3.1 Voltage Amplifier

1. Turn on the amplifier and allow it to warm up for at least one hour.

7.3.1 Voltage Amplifier (continued)

2. Disconnect any input from the amplifier.
3. Set Full Scale g Control to 5000 g (black) and the sensitivity control to 1.0 pC/g (black).
4. Set the Low Frequency Cutoff Control to 0.7 Hz.
5. Measure the dc voltage at the "sig out" (J3).
6. Depress and release the Reset button until the dc voltage has stabilized.
7. Turn the Zero Adjust potentiometer (R46) on the front panel for a dc output voltage as close to zero as possible, limited by the resolution of the potentiometer.
8. Repeat Step 6, if necessary, to stabilize the dc level.

7.3.2 Power Amplifier

1. Adjust the dc output voltage of the voltage amplifier as described in 7.3.1 above.
2. Connect the voltmeter between Pins 1 and 2 of the Galvanometer Output connector.
3. Adjust potentiometer R206 on the Power Amplifier Module for a dc output as close to zero as possible, limited by the resolution of the potentiometer.

7.3.3 Charge Converter

1. Shield the input connector from stray electrostatic pickup or connect a piezoelectric transducer to the input with a total source capacitance of approximately 1000 pF.
2. Connect the dc voltmeter between the positive lead of C12, the 2300 μF capacitor, and signal ground.
3. Set the Full Scale switch to 25 g (black).
4. Using potentiometer R7, on the charge converter circuit board, adjust the dc voltage as close to zero as possible, limited by the resolution of the potentiometer. After each change of the potentiometer, allow time for the dc voltage to settle. Depress and release the Reset button repeatedly until the dc level is stabile.

7.4 Sensitivity Adjustment

The sensitivity of the amplifier is carefully adjusted at the factory and does not normally need changing. The procedure for making the adjustment is quite complicated and, therefore, is not included in the manual. It is important that the sensitivity adjustments (R58 and R62) not be touched. If it is ever necessary to make this adjustment in the field, the procedure can be obtained from the Technical Services Department of Endevco. Write for Technical Data No. 651.

7.5 Calibration Signal Level

The calibration signal is adjusted by means of potentiometer R41 mounted on the calibration circuit board assembly

Connect a calibrated and accurate oscilloscope or peak-to-peak voltmeter to the signal output connector. The deflection sensitivity of the oscilloscope or voltmeter should be known to 0.2%. Throw the Calibrate-Operate switch to calibrate. Measure the calibration output signal for each of the Full Scale g ranges. If the signal is not 5.0 volts ±2.0% peak-to-peak on all ranges, adjust R41 to bring the calibration voltage within tolerance.

7.6 Trouble Shooting

If a malfunction occurs, the area of trouble can be found by using the following procedure:

1. Remove the amplifier from its case and measure the ±30 volt bus from the power supply. The +30 volts is a red wire and the -30 volts is orange. If these are 30 volts ±5%, then the trouble is probably in the amplifier section. If they are not, the trouble is probably in the power supply. Checking voltage throughout the power supply should indicate the trouble.

2. If the trouble seems to be in the amplifier, measure the dc voltages in the various sections and compare them to Table 1. The trouble can be located by the area of the circuit that first deviates from the expected value.

7.7 Special Precaution

When using the amplifier on the 0.03 Hz low frequency cutoff and at high gain, it is very important that the leakage resistance between the signal input and ground be kept very high. If this resistance drops due to contamination or some other reason, the output zero will offset. In order to keep this offset to a minimum, the leakage resistance should be greater than 50 megohms. Therefore, if an erratic zero is noted when on the 0.03 Hz low frequency cutoff, a check of cable and connections should be made. (See Section 1.2.)

7.8 Factory Repairs

If serious trouble occurs, the instrument should be returned to the factory for repair. Whenever possible, it should be accompanied by supplementary information, describing in particular the fault noted. Address shipment and correspondence to:

Customer Service
Endevco
801 S. Arroyo Parkway
Pasadena, CA 91109

7.8 Factory Repairs (continued)

Endevco warrants each new instrument to be free from defects in material and workmanship for one year from date of sale to the original purchaser. This warranty does not extend to vacuum tubes and transistors in the units, nor to units which have been misused or used in violation of Endevco recommendations, nor to units which have been altered or repaired outside Endevco's factory. Defects covered by this warranty will be remedied at no charge when the instrument is delivered to the factory with all transportation charges prepaid. If upon examination it is found that the defect is not within the scope of this warranty, a statement of repair charges and a request for authorization to proceed will be submitted.

TABLE 1 - TYPICAL DC OPERATING VOLTAGES

Conditions

Input:	115 VAC
Sensitivity:	1.0
Full Scale g:	25
Low Frequency Cutoff:	.7

Equipment

Simpson 260-3 Voltmeter

CHARGE CONVERTER
(Terminal Board No. 1)

Q	BASE	EMITTER	COLLECTOR
1	+17.5 V	+.4 V	0
2	+17.5 V	+10 V	+20 V
3	+20 V	+19 V	+30 V
4	+19 V	+20 V	0
5	+.09 V	0	+21 V
6	-.1 V	0	-20.5 V

CALIBRATOR
(Terminal Board No. 2)

Q	BASE	EMITTER	COLLECTOR
11	+4.6 V	+4.5 V	+30 V
12	+1.9 V	+1.35 V	+17 V
13	+17 V	+8.3 V	+30 V
14	+17 V	+8.3 V	0

VOLTAGE AMPLIFIER
(Terminal Board No. 3)

Q	BASE	EMITTER	COLLECTOR
7 in	0	- .6 V	+16.3 V
7 out	-.13 V	- .6 V	+16.5 V
8 in	- .6 V	-1.2 V	+16.3 V
8 out	- .6 V	-1.2 V	+16.5 V
9	+16.5 V	+17.1 V	0
10	+16.3 V	+16.9 V	- .6 V
11	- .6 V	+.08 V	-6.5 V

POWER AMPLIFIER
(Terminal Board No. 4)

Q	BASE	EMITTER	COLLECTOR
201	0	- .6 V	+9.5 V
202	+9.5 V	+9.5 V	+30 V
203	+ .8 V	+ .7 V	+8.6 V
204	-.84 V	-.78 V	-8.6 V
205	+ .7 V	+.23 V	+8.6 V
206	+ .8 V	+.13 V	+.23 V
207	- .9 V	-.08 V	-.12 V
208	- .8 V	-.12 V	-8.6 V

POWER SUPPLY
(Terminal Board No. 5, +30 V; Terminal Board No. 6, -30 V)

Q	BASE	EMITTER	COLLECTOR
101	+8.5 V	+ 8 V	+21 V
102	-8.5 V	- 8 V	-21 V
103	+8.5 V	+ 8 V	+21 V
104	-8.5 V	- 8 V	-21 V
105	+21 V	+20 V	+30 V
106	-21 V	-20 V	-30 V
107	+21 V	+20 V	+30 V
108	-21 V	-20 V	-30 V
109	+ 8 V	+30 V	+48 V
110	- 8 V	-30 V	-48 V
111	+30 V	+ 8 V	+48 V
112	-30 V	- 8 V	-48 V
113	+45 V	+48 V	+30 V
114	-45 V	-48 V	-30 V

ELECTRICAL PARTS LIST
FOR
MODEL 2718A SHOCK AMPLIFIER

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
CALIBRATION BOARD ASSEMBLY				
C15	Capacitor	2.2 μF, ±10%, 35 V, Tantalum	Sprague 150D225X9035B2	EC63
C16	Capacitor	.047 μF, ±5%, 50 V, Paper	San Fernando Elec. WS4J473	EC246
C17	Capacitor	100 μF, 12 V, Electrolytic	Sprague 30D107G012CC4	EC220
C18	Capacitor	6.8 μF, ±10%, 35 V, Tantalum	Sprague 150D685X9035B2	EC276
CR12	Diode	1N936, Zener T. C.	Motorola	ECR63
CR13	Diode	1N456, Silicon	Hughes	ECR31
L3	Inductor	0.5 H, ±2%, 50 mH, Toroid		12795
Q11	Transistor	2N388A	Texas Instruments	EQ81
Q12	Transistor	2N2923	Texas Instruments	EQ94
Q13	Transistor	2N388A	Texas Instruments	EQ81
Q14	Transistor	2N404A	Texas Instruments	EQ82
R33	Resistor	33 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER196
R34	Resistor	11 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1022
R35	Resistor	12 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER249
R36	Resistor	15 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER168
R37	Resistor	15 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER168
R38	Resistor	3 kΩ ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER158
R39	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R40	Resistor	7.5 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER719
R41	Potentiometer	1 kΩ, ±10%, 1/2 W, WW	Bourns 3067P-1-102	ER829

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
CALIBRATION BOARD ASSEMBLY (continued)				
R42	Resistor	1.8 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER293
R50	Resistor	2.2 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER169
R51	Resistor	2.2 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER169
R52	Resistor	1 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER23
R54	Resistor	1 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER23
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
C1	Capacitor	500 pF, ±1%, 500 V, Sil. Mica	Elmenco DM-15-501F	EC232
C2	Capacitor	5060 pF, ±1%, 300 V, Dura-Mica	Elmenco DM-19-5061F	EC360
C3	Capacitor	1000 pF, ±1%, 500 V, Sil. Mica	Elmenco DM-19-102F	EC19
C4	Capacitor	1.0 μF, ±20%, 50 V, Tantalum	Sprague 150D105X0050A2	EC209A
C5	Capacitor	620 pF, ±5%, 300 V, Sil. Mica	Elmenco DM-15-621J	EC544
C6	Capacitor	4.7 μF, ±20%, Tantalum, 10V	Sprague 150D475X0010A2	EC150
C7	Capacitor	2.2 μF, ±20%, 20 V, Tantalum	Sprague 150D225X0020A2	EC204
C8	Capacitor	5 μF, ±10%, 100 V, Mylar Metalized	Elpak Z1X505K	EC479
C9	Capacitor	1000 pF, ±5%, 100 V, Dura-Mica	Elmenco DM-15-102J	EC359
C10	Capacitor	0.1 μF, ±20%, Tantalum, 35V	Sprague 150D104X0035A2	EC149
C11	Capacitor	0.1 μF, ±20%, Tantalum, 35V	Sprague 150D104X0035A2	EC149
C12	Capacitor	2300 μF, $^{+75}_{-10}$%, 5 V, Electrolytic	Sprague 601D238G005FL4	EC427
C13	Capacitor	680 pF, ±5%, 300 V, Sil. Mica	Elmenco DM-15-681J	EC106
C14	Capacitor	15 pF, ±5%, 500 V, Dura-Mica	Elmenco DM-15-150J	EC377
C15	Capacitor	47 pF, ±5%, 500 V, Sil. Mica	Elmenco DM-15-470 J	EC113
C16	Capacitor	.01 μF, ±20%, 50 V, Ceramic	Sprague 19C214A6	EC115
C17	Capacitor	100 pF, ±5%, 500 V, Sil. Mica	Elmenco DM-15-101J	EC234
C21	Capacitor	.01 μF, ±20%, 50 V, Ceramic	Sprague 19C214A6	EC115

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
C101	Capacitor	0.05 μF, ±20%, 50 V, Ceramic	Sprague 55C23A1	EC324
C102	Capacitor	0.05 μF, ±20%, 50 V, Ceramic	Sprague 55C23A1	EC324
C103	Capacitor	10 μF, $^{+75}_{-10}$%, 25 V, Electrolytic	Sprague 30D106G025BB4	EC242
C104	Capacitor	10 μF, $^{+75}_{-10}$%, 25 V, Electrolytic	Sprague 30D106G025BB4	EC242
C105	Capacitor	680 pF, ±5%, 300 V, Sil. Mica	Elmenco DM-15-681J	EC106
C106	Capacitor	680 pF, ±5%, 300 V, Sil. Mica	Elmenco DM-15-681J	EC106
C107	Capacitor	.1 μF, ±20%, 50 V, Film	San Fernando Elec. WS4M104	EC314
C108	Capacitor	.1 μF, ±20%, 50 V, Film	San Fernando Elec. WS4M104	EC314
C109	Capacitor	.1 μF, ±20%, 50 V, Film	San Fernando Elec. WS4M104	EC314
C110	Capacitor	.1 μF, ±20%, 50 V, Film	San Fernando Elec. WS4M104	EC314
C111	Capacitor	.02 μF, $^{+80}_{-20}$%, 50 V, Ceramic	Sprague 55C21A2 or TG-S20	EC273
C112	Capacitor	.02 μF, $^{+80}_{-20}$%, 50 V, Ceramic	Sprague 55C21A2 or TG-S20	EC273
C113	Capacitor	80 μF, 150 V, Electrolytic	Cornell-Dubilier BR-80-150	EC325
C114	Capacitor	80 μF, 150 V, Electrolytic	Cornell-Dubilier BR-80-150	EC325
C121	Capacitor	250 μF, 25 V, Electrolytic	Cornell-Dubilier BR-250-25	EC456
C122	Capacitor	250 μF, 25 V, Electrolytic	Cornell-Dubilier BR-250-25	EC456
C201	Capacitor	100 μF, 12 V, Electrolytic	Sprague 30D107G012CC4	EC220
C202	Capacitor	1000 pF, ±5%, 100 V, Dura-Mica	Elmenco DM-15-102J	EC359
CR1	Diode	1N960, Zener	Fairchild	ECR189
CR2	Diode	1N960, Zener	Fairchild	ECR189
CR3	Diode	Zener		13643
CR4	Diode	1N961, Zener	Motorola	ECR62
CR5	Diode	1N456, Silicon	Hughes	ECR31A

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
CR6	Diode	1N754		ECR83
CR11	Diode	1N456, Silicon	Hughes	ECR31
CR101	Diode	1N936, Zener T. C.	Motorola	ECR63
CR102	Diode	1N936, Zener T. C.	Motorola	ECR63
CR103	Diode	1N456, Silicon	Hughes	ECR31
CR104	Diode	1N456, Silicon	Hughes	ECR31
CR105	Diode	1N456, Silicon	Hughes	ECR31
CR106	Diode	1N456, Silicon	Hughes	ECR31
CR107	Diode	1N456, Silicon	Hughes	ECR31
CR108	Diode	1N456, Silicon	Hughes	ECR31
CR109	Diode	1N456, Silicon	Hughes	ECR31
CR110	Diode	1N456, Silicon	Hughes	ECR31
CR112	Diode	1N456, Silicon	Hughes	ECR31
CR113	Diode	1N456, Silicon	Hughes	ECR31
CR114	Diode	1N456, Silicon	Hughes	ECR31
CR115	Diode	1N456, Silicon	Hughes	ECR31
CR117	Diode	SCBR-4, Quad	Semtech	ECR79
CR118	Diode			
CR119	Diode			
CR120	Diode			
CR125	Diode	1N961, Zener	Motorola	ECR62
CR126	Diode	1N961, Zener	Motorola	ECR62
CR127	Diode	SCBR-4, Quad	Semtech	ECR79
CR128	Diode			

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
CR129	Diode			
CR130	Diode			
CR201	Diode	1N961, Zener	Motorola	ECR62
CR202	Diode	1N456, Silicon	Hughes	ECR31
CR203	Diode	1N456, Silicon	Hughes	ECR31
CR204	Diode	1N456, Silicon	Hughes	ECR31
CR205	Diode	1N456, Silicon	Hughes	ECR31
F101	Fuse	3/4 Amp, Slo-Blo, 125 V	Littelfuse 313.750	EF16
F101	Fuse	Optional, 3/8 Amp, 250 V	Fusetron MDL	EF26
I101	Indicator Light	Lamp Pilot Assembly	Eldema BG03-CCS-NE2H-033K	EXI23
J1	Connector	Input	Microdot 31-33	EJ132
J1	Connector	Input (Optional) BNC	Amphenol 31-221	EJ15
J2	Connector	Galvanometer Output	Switchcraft B3M	EJ75
J3	Connector	BNC, Signal Output	Amphenol 31-221	EJ15
J5	Connector	Binding Post, Transformer Shield	Raytheon 227-1214G3	EJ42
J6	Connector	Input Power	Hubble 7486	EJ82
J7	Connector	5-pin, for Peak Holding Meter	Cannon WK-5-32S	EJ251
J8	Connector	Phone Jack	Switchcraft 13B	EJ254
Q1	Transistor	F.E.T.		14853-2
Q2	Transistor	2N3904	Motorola	EQ130
Q3	Transistor	2N3904	Motorola	EQ130
Q4	Transistor	2N1377	Texas Instrument	EQ100

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
Q5	Transistor	2N388A	Texas Instruments	EQ81
Q6	Transistor	2N404A	Texas Instruments	EQ82
Q7	Transistor	SA2253 (Dual)	Amelco	EQ107
Q8	Transistor	SA2253 (Dual) Selected	Amelco	EQ150
Q9	Transistor	2N3906	Motorola	EQ127
Q10	Transistor	2N3906	Motorola	EQ127
Q11	Transistor	2N3906	Motorola	EQ127
Q101	Transistor	2N3904	Motorola	EQ130
Q102	Transistor	2N3906	Motorola	EQ127
Q103	Transistor	2N3904	Motorola	EQ130
Q104	Transistor	2N3906	Motorola	EQ127
Q105	Transistor	2N3904	Motorola	EQ130
Q106	Transistor	2N3906	Motorola	EQ127
Q107	Transistor	2N3904	Motorola	EQ130
Q108	Transistor	2N3906	Motorola	EQ127
Q109	Transistor	2N3766	Motorola	EQ131
Q110	Transistor	2N3740	Motorola	EQ129
Q111	Transistor	2N3904	Motorola	EQ130
Q112	Transistor	2N5400	Motorola	EQ216
Q113	Transistor	2N3906	Motorola	EQ127
Q114	Transistor	2N3904	Motorola	EQ130
Q119	Transistor	2N3766	Motorola	EQ131
Q120	Transistor	2N3740	Motorola	EQ129
Q201	Transistor	2N3904	Motorola	EQ130
Q202	Transistor	2N3904	Motorola	EQ130
Q203	Transistor	2N3904	Motorola	EQ130

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
Q204	Transistor	2N3906	Motorola	EQ127
Q205	Transistor	2N696	Fairchild	EQ83
Q206	Transistor	2N696	Fairchild	EQ83
Q207	Transistor	2N1131	Fairchild	EQ84
Q208	Transistor	2N1131	Fairchild	EQ84
R1	Resistor	1 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER23
R2	Resistor	600 MΩ, ±20%, 1/2 W, Comp.	I.R.C. GBT 1/2	ER800
R3	Resistor	66 MΩ, ±20%, 1/2 W, Comp.	I.R.C. GBT 1/2	ER1172
R4	Resistor	33 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER196
R5	Resistor	62 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1021
R6	Resistor	620 k Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1557
R7	Potentiometer	2 kΩ, ±5%, 1-1/2 W,	Spectrol 55-2-11-202	ER1675
R8	Resistor	3.3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER163
R9	Resistor	1.5 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER94
R10	Resistor	100 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER233
R11	Resistor	1.3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER60
R12	Resistor	1.3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER60
R13	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R14	Resistor	120 kΩ, ±5%, 1/4 W, Comp.	Allen Bradley Type CB	ER202A
R15	Resistor	22 MΩ, ±5%, 1/4 W, Comp.	Allen Bradley Type CB	ER88
R16	Resistor	1.5 MΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER55
R17	Resistor	100 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER233
R18	Resistor	240 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER248
R19	Resistor	5.6 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER126
R20	Resistor	100 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER171

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
R21	Resistor	2.2 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER169
R22	Resistor	11 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1022
R23	Resistor	10 kΩ,±.5%, 1/10W, Metal Film	Mepco FE10	ER802
R24	Resistor	5.0 kΩ±.5%,1/10 W, Metal Film	Mepco FE10	ER1061
R25	Resistor	975 Ω±.5%, 1/10 W, Metal Film	Mepco FE10	ER1579
R26	Resistor	24 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1507
R27	Resistor	3.3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER163
R28	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R29	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R30	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R31	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R32	Resistor	3.3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER163
R33	Resistor	1 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER23
R34	Resistor	9.5 kΩ,±.5%,1/10 W, Metal Film	Mepco FE10	ER1363
R35	Resistor	9.0 kΩ,±.5%,1/10W, Metal Film	Mepco FE10	ER1362
R36	Resistor	5.0 kΩ,±.5%,1/10W, Metal Film	Mepco FE10	ER1061
R38	Resistor	9.5 kΩ,±.5%,1/10W, Metal Film	Mepco FE10	ER1363
R39	Resistor	9.0 kΩ,±.5%,1/10 W, Metal Film	Mepco FE10	ER1362
R40	Resistor	5.0 kΩ,±.5%,1/10W, Metal Film	Mepco FE10	ER1061
R41	Resistor	22 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER818
R42	Resistor	22 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER818
R43	Resistor	22 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER818
R44	Resistor	56 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1020
R45	Resistor	180 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1128
R46	Potentiometer	5 kΩ, ±5%, 1-1/2 W, WW	Bourns 3052S-1-502M	ER1552

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
R47	Resistor	1.8 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER293
R48	Resistor	10 kΩ, ±1%, 1/10W, Metal Film	Mepco FE10	ER808
R49	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R50	Resistor	6.8 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER819
R51	Resistor	82.5 kΩ, ±1%,1/10 W, Metal Film	Mepco FE10	ER814
R52	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R53	Resistor	27 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER820
R54	Resistor	2.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER197
R55	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R56	Resistor	1.8 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER293
R57	Resistor	43 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1008
R58	Potentiometer	200 Ω, ±10%, 1/2 W, WW	Bourns 3067P-1-201	ER826
R59	Potentiometer	2.0 kΩ, ±3%, 2 W, 10 Turns, WW	Bourns 3500S-714-202	ER827
R60	Resistor	150 Ω, ±1%,1/10 W, Metal Film	Mepco FE10	ER815
R61	Resistor	5.6 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER126
R62	Potentiometer	5 kΩ, ±10%, 1/2 W, WW	Bourns 3067P-1-502	ER792
R63	Resistor	2.55 kΩ, ±.5%,1/10 W, Metal Film	Mepco FE10	ER809
R64	Resistor	2.05 kΩ, ±.5%,1/10 W, Metal Film	Mepco FE10	ER810
R65	Resistor	255 Ω, ±.5%, 1/10W, Metal Film	Mepco FE10	ER811
R66	Resistor	205 Ω, ±.5%, 1/10W, Metal Film	Mepco FE10	ER812
R67	Resistor	25.5 Ω, ±.5%, .05 W, WW	RCL Type 7005	ER978
R68	Resistor	25.5 Ω, ±.5%, .05 W, WW	RCL Type 7005	ER978
R69	Resistor	11.5 kΩ, ±1%,1/10 W, Metal Film	Mepco FE10	ER838
R78	Resistor	475 Ω, ±.5%,1/10 W, Metal Film	Mepco FE10	ER1492
R101	Resistor	10 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER945
R102	Resistor	10 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER945

ELECTRICAL PARTS LIST (continued)

Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
R103	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R104	Resistor	560 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER823
R105	Resistor	560 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER823
R106	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R107	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R108	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R109	Resistor	33 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1006
R110	Resistor	2.4 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER295
R111	Resistor	2.4 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER295
R112	Resistor	33 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER1006
R113	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R114	Resistor	4.7 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER270
R115	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R116	Potentiometer	1 kΩ, ±10%, 1/2 W, WW	Bourns 3067P-1-102	ER829
R117	Resistor	3.9 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER164
R118	Resistor	3.9 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER164
R119	Potentiometer	1 kΩ, ±10%, 1/2 W, WW	Bourns 3067P-1-102	ER829
R120	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R121	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R122	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R123	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R124	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R125	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R126	Resistor	680 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER159
R127	Resistor	27 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER820
R128	Resistor	27 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER820

ELECTRICAL PARTS LIST (continued)

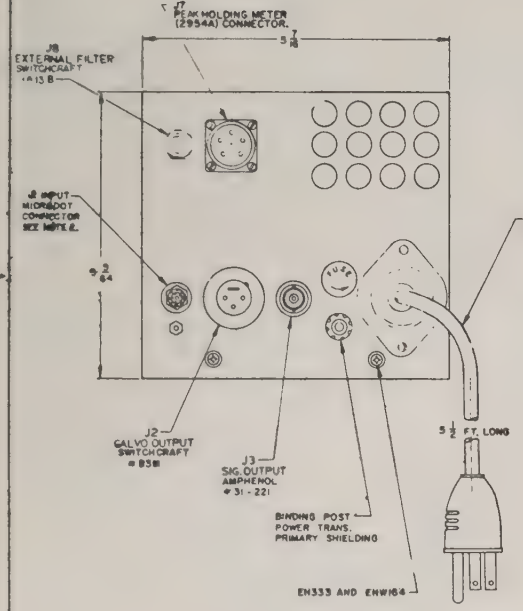
Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No.
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
R129	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R130	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R131	Resistor	20 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER671
R132	Resistor	20 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER671
R133	Resistor	820 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER56
R134	Resistor	820 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER56
R135	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R136	Resistor	47 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER824
R137	Resistor	1.5 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER832
R138	Resistor	1.5 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER832
R140	Resistor	3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER158
R141	Resistor	3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER158
R142	Resistor	5 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER1493
R143	Resistor	5 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER1493
R144	Resistor	10 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER974
R145	Resistor	10 Ω, ±5%, 5 W, WW	Ward Leonard 5F	ER974
R201	Resistor	5.36 kΩ, ±1%, 1/10W, Metal Film	Mepco FE10	ER816
R202	Resistor	511 Ω, ±1%, 1/10W, Metal Film	Mepco FE10	ER807
R203	Resistor	33 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER196
R204	Resistor	470 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER156
R205	Potentiometer	6 kΩ, ±10%, 1/2 W, Carbon	Chicago Telephone 45	12125
R206	Potentiometer	1 kΩ, ±10%, 1/2 W, WW	Bourns 3067P-1-102	ER829
R207	Resistor	10 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER182
R208	Resistor	5.6 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER126
R209	Resistor	33 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER196
R210	Resistor	1.5 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER94

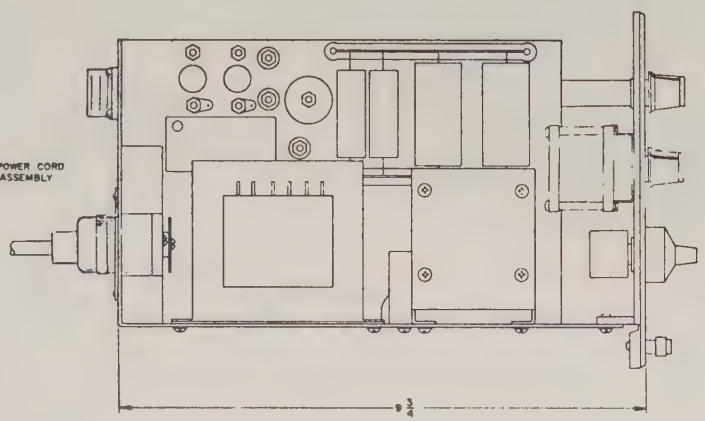
ELECTRICAL PARTS LIST (continued)

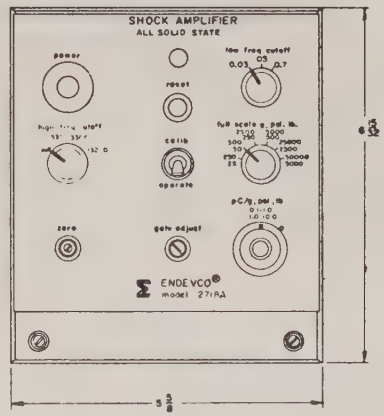
Des. No.	Part	Value and Description	Manufacturer and No.	Endevco Part No
MODEL 2718A PARTS (Not Including Calibration Board Assembly)				
R211	Resistor	1.5kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER94
R212	Resistor	33 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER196
R213	Resistor	3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER158
R214	Resistor	3 kΩ, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER158
R215	Resistor	10 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER945
R216	Resistor	10 Ω, ±5%, 1/2 W, Comp.	Allen Bradley Type EB	ER945
R217	Resistor	Selected	Allen Bradley Type EB	
R218	Resistor	Selected	Allen Bradley Type EB	
S1	Switch	Three Position (One Section)	C. T. S.	14149
S2	Switch	Four Position	C. T. S.	15549
S3	Switch	Six Positions (Six Sections)	C. T. S.	14148
S4	Switch	Toggle	Arrowhart 83054C	ES56
S5	Switch	DP-DT Black Button	2PB 11 Micro Switch	ES93
S101	Switch	Push Switch	Control Corp. of Amer. J4004	ES57
T101	Transformer	Power		14513
LOW PASS FILTERS				
C22	Capacitor	.47μF, ±5%, 100V, Met. Mylar	Marshall D1-474D	EC563
C23	Capacitor	.047μF, ±5%, 50V	San Fernando Elect., WS4J473	EC246
C24	Capacitor	.012μF, ±5%, 50V	San Fernando Elect., WS4J123	EC247
R79	Resistor	100Ω ±5%, 1/2W, Comp	A.B. Type EB	ER171

PART NO.	DESCRIPTION	QTY.
2718A	SHOCK AMPLIFIER	1
EP18	PLUG, AMPHENOL #31-021	1
EP6	PLUG, CANNON XLR-3-11C	1
2190-4	PWR CORD ASSY	1
EM333	SCREW #4-40 x 3/8	2
EHW#64	LOCKWASHER #4	2
2991	CARRYING CASE	OPT
2991MI	CARRYING CASE	OPT
4992A	RACK	OPT
EP18	PLUG, FOR 2718AT OPT.	OPT

DWG	LTR	CHANGE DESCRIPTION	BY	DATE
	1	SHIPPED AS 2718D		
	18	WHEN FREQ CUTOFF WAS ADDED		
	18	LISTED AND PICTURE		
	2	ADDED CAL OUTPUT TO J1 ADDED SIG OUTPUT TO J3		


J7 PEAK HOLDING METER (2954A) CONNECTOR.
5 7/16
J1 EXTERNAL FILTER SWITCHCRAFT #A13B
J3 INPUT MICRODOT CONNECTOR SEE NOTE 2.
2 3/64
FUSE
POWER CORD ASSEMBLY
5 1/2 FT. LONG
J2 CALVO OUTPUT SWITCHCRAFT #13B
J3 SIG. OUTPUT AMPHENOL #31-221
BINDING POST POWER TRANS. PRIMARY SHIELDING
EM333 AND EHW#64





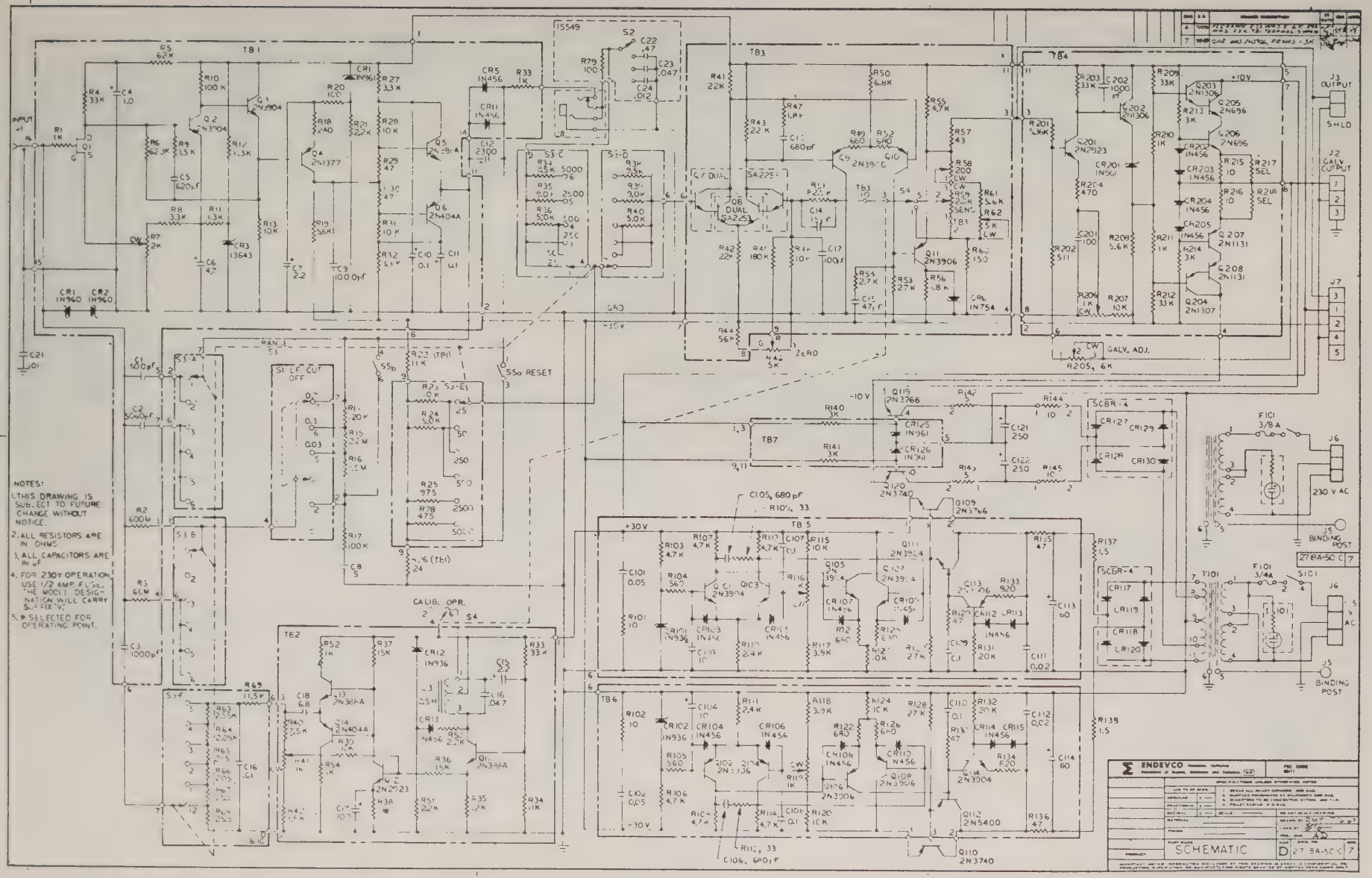
D-2718A-C 2

NOTES:

1. IF UNIT IS WIRED FOR 230 V OPERATION MODEL SERIAL PLATE WILL CARRY MODEL DESIGNATION WITH SUFFIX "V"
2. WHEN BNC INPUT CONNECTOR INSTALLED MODEL SERIAL PLATE WILL CARRY MODEL DESIGNATION WITH SUFFIX "T".
3. THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOLT NOTICE.

ENDEVCO
Pasadena, California

UNITS OF DIMS		
ANGULAR		
FRACTIONAL		
MATERIAL		
FINISH		
NEXT ASSY		
PRODUCT	SHOCK AMPLIFIER	D 2718A-C 2


NOTES:
1. THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.
2. ALL RESISTORS ARE IN OHMS
3. ALL CAPACITORS ARE IN uF
4. FOR 230V OPERATION USE 1/2 AMP FUSE. THE MODEL DESIGNATION WILL CARRY SUFFIX "V".
5. * SELECTED FOR OPERATING POINT.
ENDEVCO
SCHEMATIC
D127 BA-50-C 7

ITEM	PART NO	DESCRIPTION	QTY	
			1	2
1	15445	PRELIMINARY ASSEMBLY	1	1
2	15388	FRONT PANEL ASSEMBLY	1	1
3	14144C	CIRCUIT BOARD ASSEMBLY, CHG CONVERTER	1	1
4	13265C 1	CIRCUIT BOARD ASSEMBLY, CALIBRATION	1	1
5	14185C	CIRCUIT BOARD ASSEMBLY, VOLTAGE AMP	1	1
6	35003C	POWER AMPLIFIER MODULE	1	1
7				
8	14147	SHIELD, CHARGE CONVERTER	1	1
9	EC11C	CAPACITOR, .01uF (.02)	1	1
10	EH136	CLAMP, CABLE, 1/8 I.D.	1	1
11	EH137	CLAMP, CABLE, 1/4 I.D.	1	1
12	EH143	CLAMP, CABLE, 3/8 I.D.	1	1
13	EH138	LUG, GROUND, #15 I.D.	1	1
14	EH318	SCREW, 8-32 X 1/4	14	14
15	EH324	SCREW, 4-40 X 5/16	2	2
16	EH326	SCREW, 6-32 X 3/8	3	3
17	EH333	SCREW, 4-40 X 3/8	3	3
18	EH369	SCREW, 4-40 X 3/16	5	5
19	EH814	WASHER, FLAT, FIBER #8	2	2
20	EH8-64	LOCKWASHER, INT #4	7	7
21	EH8-65	LOCKWASHER, INT #6	5	5
22	EH8-56	WASHER, SHOULDER, FIBER 3/8	1	2
23	EH866	NUT, HEX #6-32	3	3
24	EH8117	BRACKET, CIRCUIT BOARD	2	2
25	EH8[illegible]	WASHER, FLAT	1	—
26	—	[illegible]	—	1
27	3666-10	MYLAR LABEL	1	1
28	2910-19	AC IDENTIFICATION LABEL	—	1
29	EH8141	WASHER, FLAT #6	3	3
30	—	ADHESIVE, (EASTMAN 910)	AR	AR
31	—	TOOL, D.P. INS. .1 (.33 IN.)	AR	AR
32	EW83	TUBING, TEFLON	AR	AR
33	EW39	WIRE, BUS #22AWG	AR	AR
34	EW30	WIRE, BUS #20AWG	AR	AR
35	EW14	TUBING, TEFLON	AR	AR
36				
37				
38				
39				
		2718T OPTION (BNC INPUT CONNECTOR)		
11	EJ15	BNC CONNECTOR		1
45	EH18	LUG, SOLDER		1
46	EH8169	LOCKWASHER, INT 3/8 I.D.		1
47	13236	BUSHING EXTENDER		1

NOTES:

(1) THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

(2) QUANTITY -1 FOR 2718A STANDARD; -2 FOR 2718AT (SUFFIX "T" TO BE ADDED TO MODEL DESIGNATION ON MYLAR LABEL (ITEM 27)

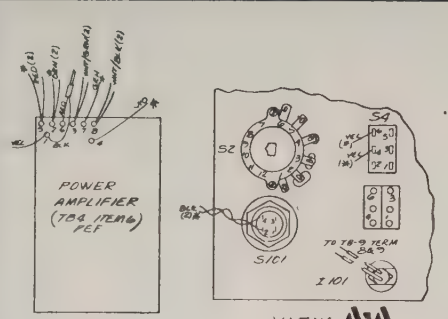
(3) ALL WIRE HOOKUP IS FROM MAIN HARNESS (15389) EXCEPT FOR THOSE WIRES MARKED "#" WHICH IS FROM POWER SUPPLY HARNESS 14622 OR AS NOTED

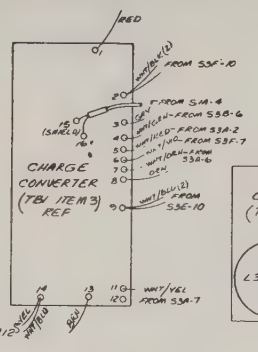
FOR 230V OPERATION:

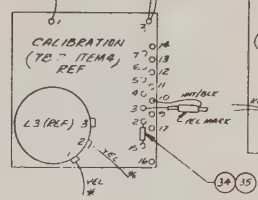
(4) a REMOVE 2910-4 - POWER CORD ASSEMBLY, LISTED ON 2718A-C PER NOTE 1 OF B-2910-4

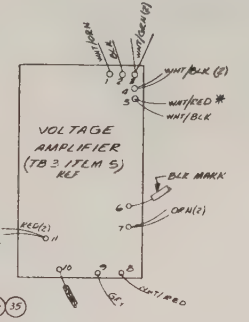
b MODEL NUMBER WILL CARRY SUFFIX "Y". SERIAL NUMBER WILL BE SUPPLIED BY PRODUCTION DEPARTMENT.

c ITEM 28 (AC IDENTIFICATION LABEL) TO READ 210-250 VOLTS, 50-400 Hz.





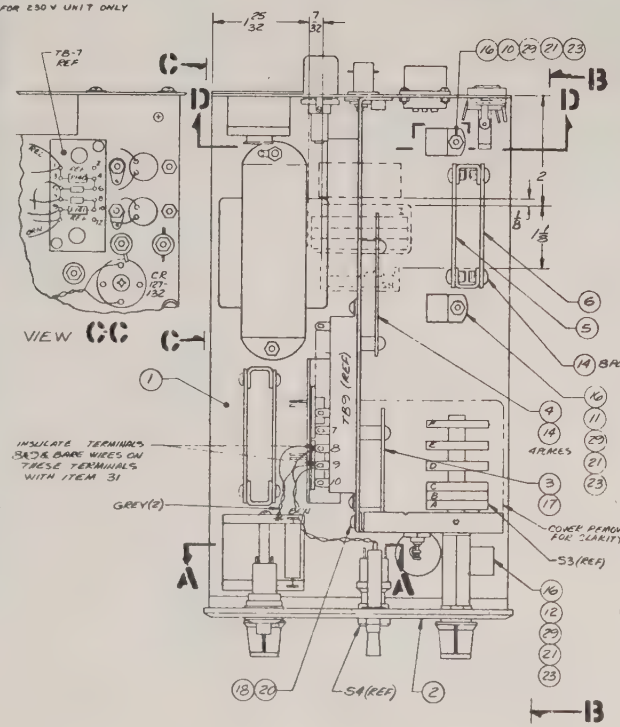


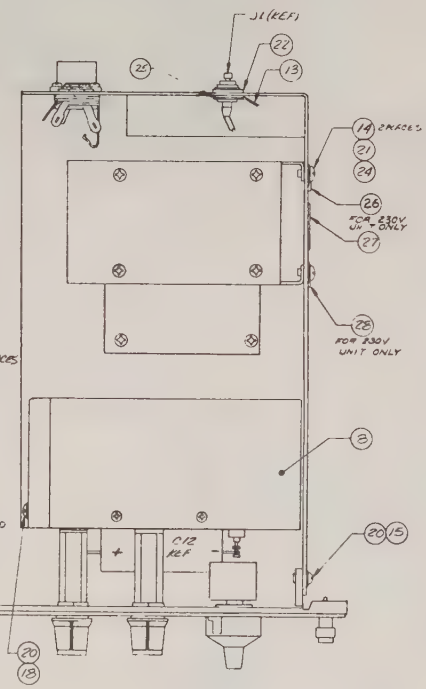


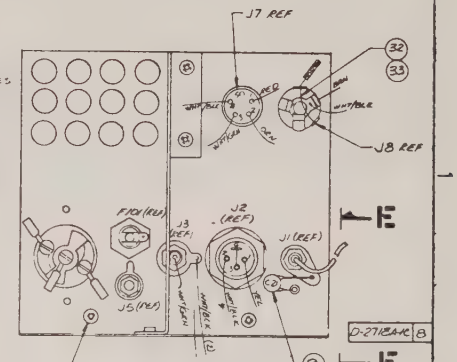
2A	6/74	RE-DRAWN (NO CHANGE)	
5	6/75	REVISED KNOB DIMENS. CHANGED ITEM 32 QTY TO 1/4, ADDED ITEM 39 (REMOVED)	
6	9/75	ADDED ITEMS 34 & 35.	
7	7/80	ADDED ITEM 26	
8	9/84	ITEM 22 WAS PART NO 3/16	

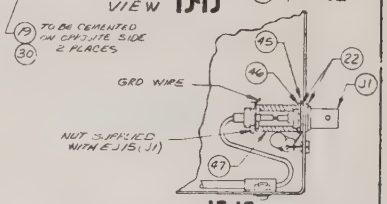
FOR 230V UNIT ONLY.

FOR 230 V UNIT ONLY





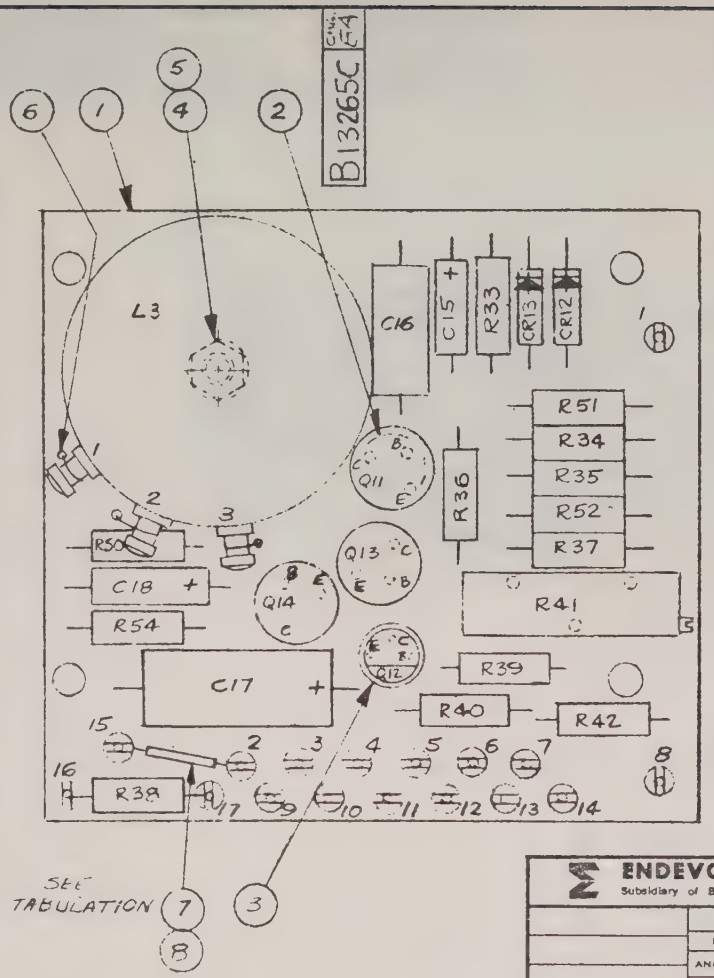




ENDEVCO		FSC CODE	
		SPECIFICATIONS UNLESS OTHERWISE NOTED	
		LTR IS NOT Q NO.	
		APPROVED	
		PROJECT ENGR.	
		DRAFTING	
		MATERIAL	LISTED
		FINISH	
2718A		PART NAME	MAIN ASSEMBLY
PRODUCT			D 2718A-C 8

LIST OF MATERIAL

ITEM	PART NO.	DESCRIPTION	QTY	C-A
1	13264	CIRCUIT BOARD	1	—
2	EHW94	TRANSIPAD	3	—
3	EHW108	TRANSIPAD	1	—
4	EHW2	LOCKWASHER #6	1	—
5	EHN34	HEX NUT #6-32	1	—
6	EW30	BUS WIRE #20 AWG	AR	—
7	EW30	BUS WIRE #20 AWG	*	—
8	EW14	TUBING, TEFLON	*	—
9		SOLDER, 63-37, ROSIN CORE	AR	—
C15	EC63	CAPACITOR, 2.2 μF	1	.590
C16	EC246	↕ , .047	1	.750
C17	EC220	↕ , .100 μF	1	1.040
C18	EC276	CAPACITOR, 6.8 μF	1	.700
CR12	ECR63	DIODE, IN936	1	.550
CR13	ECR31	DIODE, IN456	1	.550
L3	12795	INDUCTOR, 0.5H	1	—
Q11	EQ81	TRANSISTOR, 2N388A	2	—
Q12	EQ94	↕ , 2N2923	1	—
Q13	EQ81	↕ , 2N388A	—	—
Q14	EQ82	TRANSISTOR, 2N404A	1	—
R33	ER196	RESISTOR, 33K	1	.590
R34	ER1022	↕ , 11 K	1	.610
R35	ER249	↕ , 12K	1	.610
R36	ER168	↕ , 15K	2	.550
R37	ER168	↕ , 15K	—	.610
R38	*	↕ , SELECTED	—	—
R39	ER182	↕ , 10 K	1	.550
R40	ER119	RESISTOR, 7.5K	1	.550
R41	ER829	POTENTIOMETER, 1K	1	—
R42	ER253	RESISTOR, 1.8K	1	.550
R50	ER169	↕ , 2.2K	2	.590
R51	ER169	↕ , 2.2K	—	.610
R52	ER23	↕ , 1K	2	.610
R54	ER13	RESISTOR, 1K	—	.590



DASH	DESCRIPTION
-1	OMIT ITEMS 7&8
-2	INSTALL ITEMS 7&8

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
5A	5867	REDRAWN. NO CHANGE	EET 3/4/68	[illegible]	[illegible]
6	6033	ER1794 WAS ERE29	[illegible]	[illegible]	[illegible]
7	6376	ER829 WAS ER1794	WD 11-7-68	[illegible]	[illegible]
8	6483	R33 WAS ER1021, 62 K	EET 1/21/69	[illegible]	SK
8A	6561	REMOVED WHERE USED COLUMN	EET 3/7/69	[illegible]	SK

NOTE:

1. CIRCUITRY LOCATED ON FAR SIDE.
2. ITEMS 7&8 ARE NOT INSTALLED WHEN UNIT HAS AN EXTERNAL CALIBRATION. (REF.)

ENDEVCO Pasadena, California
Subsidiary of Becton, Dickinson and Company B-D

FSC CODE 85411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS
ANGULAR ± –
FRACTIONAL ± –
DECIMAL ± –

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
4. FILLET RADIUS .010 MAX.

SCALE: 2/1 — DO NOT SCALE DRAWING

2718 A
26298
2628A
2627A
PRODUCT

MATERIAL: NOTED
FINISH: —

DRAWN BY: EET 8/10/64
CHKD BY: FRANZON 8/14/64
PROJ. ENG: JR WDB

PART NAME: CALIBRATION BOARD ASSEMBLY

SIZE B | DWG. NO. 13265C | CHG 8A

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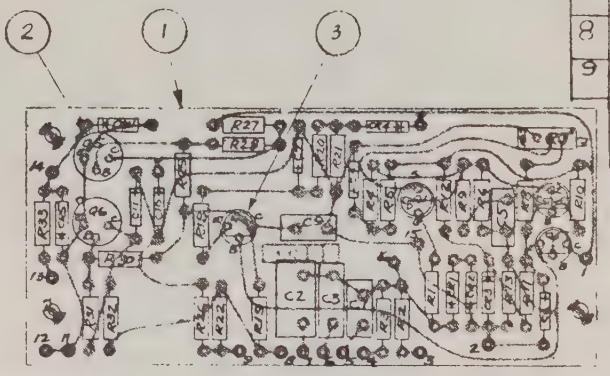
B | 14144C | CHG 11

LIST OF MATERIAL

ITEM	PART NO.	DESCRIPTION	QTY	E-C
1	14143	CIRCUIT BOARD	1	–
2	EHW94	TRANSIPAD	2	–
3	EHW108	TRANSIPAD	4	–
R1	ER23	RESISTOR, 1K	–	.560
R2	ER800	600M	1	
R3	ER1172	66M	1	
R4	ER196	33K	1	
R5	ER1021	62K	1	
R6	ER1557	RESISTOR, 620K	1	.560
R7	ER1675	POTENTIOMETER, 2K	1	–
R8	ER163	RESISTOR, 3.3K	3	.560
R9	ER94	1.5K	1	
R10	ER233	100K	1	
R11	ER60	1.3K	1	
R12	ER60	1.3K	1	
R13	ER182	10K	3	
R18	ER248	240Ω	1	
R19	ER126	5.6K	1	
R20	ER171	100Ω	1	
R21	ER169	2.2K	1	
R22	ER1022	11K	1	
R26	ER1507	24Ω	1	
R27	ER163	3.3K	–	
R28	ER182	10K	–	
R29	ER824	47Ω	2	
R30	ER824	47Ω	–	
R31	ER182	10K	–	
R32	ER163	3.3K	–	
R33	ER23	RESISTOR, 1K	–	.560
C1	EC232	CAPACITOR, 500pF	1	–
C2	EC360	5060pF	1	–
C3	EC19	1000pF	1	–
C4	EC209A	1.0μF	1	.560
C5	EC544	620pF	1	–
C6	EC150	4.7μF	1	.560
C7	EC204	2.2μF	1	.560
C8	EC359	1000pF	1	–
C10	EC149	0.1μF	2	.560
C11	EC149	CAPACITOR, 0.1μF	–	.560
CR1	ECR189	DIODE, IN960	3	.560
CR2	ECR80	IN960	–	
CR3	13643		1	
CR4	ECR62	IN961	1	
CR5	ECR31	IN456	2	.560
CR11	ECR31	DIODE, IN456	–	.560
Q1	14853-2	TRANSISTOR, FET	1	–
Q2	EQ130	2N3904	2	–
Q3	EQ130	2N3904	–	–
Q4	EQ100	2N1377	1	–
Q5	EQ81	2N3819A	1	–
Q6	EQ82	TRANSISTOR, 2N404A	1	–



CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
5	5311	REDRAWN, REREALEASED R6 WAS ER2 230 R8 WAS ER 766 C5 WAS EC341 Q1 WAS 11619	ST 5/27/67		
6	5324	R7 WAS ER1242			
7	5906	CR1 CR2 WERE ECR28, IN71			
7A	6016	C4 WAS 1.0 pF, NOW 1 F			
8	6372	Q4 WAS EQ121, 2N3906			
9	6587	Q1 WAS 14853-1	ST 8/9		
10	7006	R22 WAS ER126, 5.6K	ST 10/9		
11	7069	R12 WAS ER234 2.0K	MS 11/3		

THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

ENDEVCO
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS
ANGULAR ±
FRACTIONAL ±
DECIMAL ±

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
4. FILLET RADIUS .010 MAX.

SCALE: 1/1 — DO NOT SCALE DRAWING

MATERIAL: LISTED
FINISH: ——

DRAWN BY: WN 8/30/65
CHKD BY: GH
PROJ. ENG: GM JR SK

2718A — PRODUCT

PART NAME: CIRCUIT BOARD ASSY, CHARGE CONVERTER

SIZE: B — DWG. NO.: 14144C — CHG: 11

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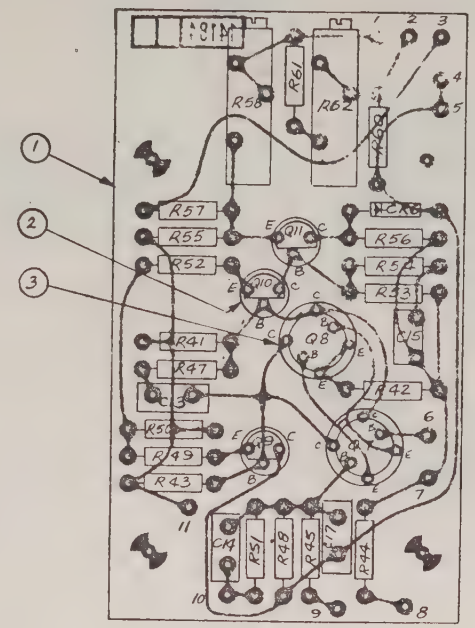
LIST OF MATERIALS

ITEM	PART NO.	DESCRIPTION	QTY	
1	14184	BOARD	1	
2	EHW108	TRANSIPAD	3	
3	EHW102	TRANSIPAD	2	
C13	EC106	CAPACITOR, 680pF	1	
C14	EC377	CAPACITOR, 15pF	1	
C15	EC113	CAPACITOR, 47pF	1	
C17	EC234	CAPACITOR, 100pF	1	
CR6	ECR83	DIODE, 1N754	1	.562
Q7	EQ107	TRANSISTOR, SA2253	1	
Q8	EQ150	TRANSISTOR, SA2253	1	
Q9	EQ127	TRANSISTOR, 2N3906	3	
Q10	EQ127	TRANSISTOR, 2N3906		
Q11	EQ127	TRANSISTOR, 2N3906		
R41	ER818	RESISTOR, 22K	3	.562
R42	ER818	22K		
R43	ER818	22K		
R44	ER1020	56K	1	
R45	ER1128	180K	1	
R47	ER293	1.8K	1	
R48	ER808	10K	1	
R49	ER159	680Ω	2	
R50	ER819	6.8K	1	
R51	ER814	82.5K	1	
R52	ER159	680Ω		
R53	ER820	27K	1	
R54	ER197	2.7K	1	
R55	ER270	4.7K	1	
R56	ER293	1.8K	1	
R57	ER1008	RESISTOR, 43Ω	1	.562
R58	ER826	POTENTIOMETER, 200Ω	1	
R60	ER815	RESISTOR, 150Ω	1	.562
R61	ER126	RESISTOR, 5.6K	1	.562
R62	ER792	POTENTIOMETER, 5K	1	

CHG	E O	CHANGE DESCRIPTION	BY DATE	CHK	APPR
3A	6350	REDRAWN. NO CHANGE.	[illegible]	[illegible]	[illegible]
4	7006	R44 WAS ER818, 22K	[illegible]	[illegible]	[illegible]



C 14185C | 4

THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

ENDEVCO Pasadena, California
Subsidiary of Becton, Dickinson and Company [B-D]

FSC CODE 5411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS: ANGULAR ± —; FRACTIONAL ± —; DECIMAL ± —
1 BREAK ALL SHARP CORNERS .008 MAX
2 SURFACE ROUGHNESS 63 MICROINCH RMS MAX
3 DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R
4 FILLET RADIUS .010 MAX. [illegible]

SCALE 2/1 — DO NOT SCALE DRAWING
MATERIAL: LISTED — DRAWN BY EET 9/2/65
FINISH: ——— — CHKD BY JWN
PROJ ENG JM JR

2718 PRODUCT

PART NAME: CIRCUIT BOARD ASSEMBLY, VOLTAGE AMP

SIZE C — DWG NO. 14185C — CHG 4

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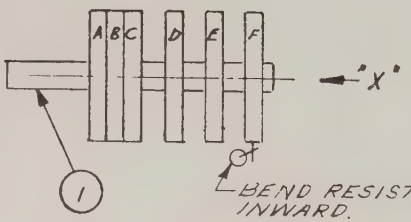
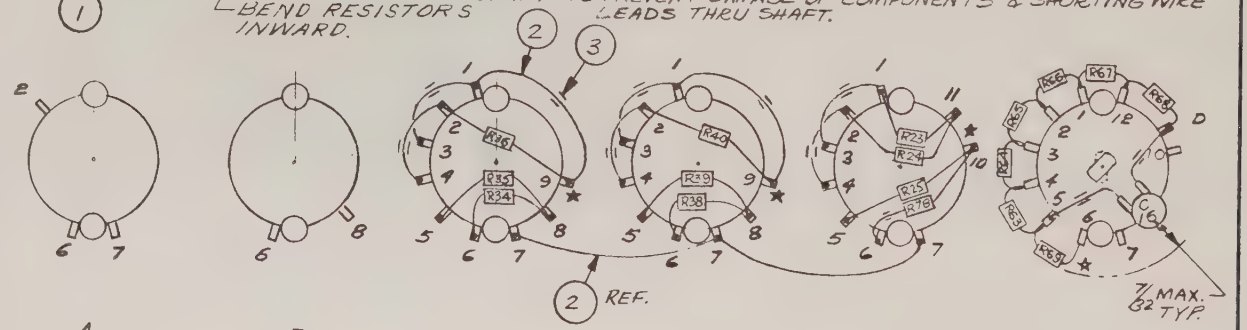
ITEM	PART #	DESCRIPTION	QTY.
1	14148	SWITCH ROTARY	1
2	EW39	#22 AWG BUS WIRE	A.R.
3	EW 14	SLEEVING	A.R.
R23	ER802	RESISTOR 10K	1
R24	ER1061	" 5K	3
R25	ER1579	" 975Ω	1
R34	ER1363	" 9.5K	2
R35	ER1362	" 9K	2
R36	ER1061	" 5K	—
R38	ER1363	" 9.5K	—
R39	ER1362	" 9K	—
R40	ER1061	" 5K	—
R63	ER809	" 2.55K	1
R64	ER810	" 2.05K	1
R65	ER811	" 255Ω	1
R66	ER812	" 205Ω	1
R67	ER978	" 25.5Ω	2
R68	ER978	" 25.5Ω	—
R69	ER838	" 11.5K	1
R78	ER1492	" 475Ω	1
C16	EC115	CAPACITOR .01μF	1

B14188C 3A

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
1	4320	RELEASED	ET 9/15/65	[illegible]	[illegible]
2	4521	7/32 DIM. WAS 3/8. ADDED RESISTOR MTG. NOTE.	FG 1/24/66	[illegible]	[illegible]
3	4636	ADD LUG 10 TO DECK F CHANGE R25 TO 975 SL	RT 3/16/66	[illegible] 3/17/66	[illegible]
3A	5098	ADDED NOTE 5 & PICTORIAL CHG. OF DECK "E".	ET 3/16/67	[illegible]	[illegible]



NOTES:
1. THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.
2. RESISTOR LEADS AND ALL BARE WIRE MARKS THUS ⏤ TO HAVE ADEQUATE SLEEVING (ITEM 3).
3. DO NOT SOLDER (AT THIS LEVEL) TERMINALS MARKED ★
4. WAFERS SHOWN ON THIS DRAWING ARE VIEWED FROM ARROW "X" DIRECTION.
5. INSTALL SHOWN COMPONENTS FAR ENOUGH (3/32 MIN) FROM SHAFT TO PREVENT DAMAGE OF COMPONENTS & SHORTING WIRE LEADS THRU SHAFT.



ENDEVCO CORPORATION
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS.
ANGULAR ± —
FRACTIONAL ± —
DECIMAL ± —

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
4. FILLET RADIUS .010 MAX.

SCALE: ——— DO NOT SCALE DRAWING

MATERIAL: LISTED
FINISH: ———

DRAWN BY: EET 9/15/65
CHKD BY: [illegible]
PROJ. ENG: [illegible]

27.18 PRODUCT

PART NAME: SWITCH ASSY-RANGE

SIZE B | DWG. NO. 14138C | CHG 3A

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS COMPANY CONFIDENTIAL. REPRODUCTION, DUPLICATION, OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY.

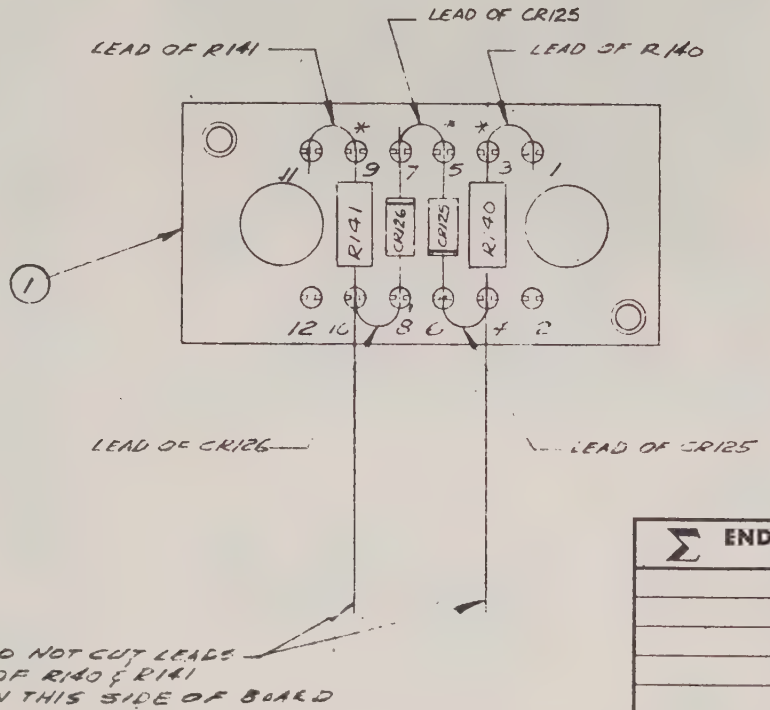
3/63 DIETERICH-POST CLEARPRINT 1000H-10

BILL OF MATERIAL

ITEM	PART NO	DESCRIPTION	QTY
1	12472	TERMINAL BOARD ASSEMBLY	1
R140	ER158	RESISTOR, 3K	2
R141	ER155	RESISTOR, 3K	—
CR125	ECR62	DIODE, IN961	2
CR126	ECR62	DIODE, IN961	—

B-14523C 2

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
1	4380	RELEASED	RLL 2-18-66	RLL	
2	4478	R140 & R141 WERE ER294	RLL 6-14-66	RLL	



DO NOT SOLDER CONNECTIONS AT TERMINALS MARKED * AT THIS LEVEL

ENDEVCO
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS.
ANGULAR ± —
FRACTIONAL ± —
DECIMAL ± —

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
4. FILLET RADIUS .010 MAX.

SCALE: 2:1
DO NOT SCALE DRAWING
MATERIAL: LISTED
FINISH: —
DRAWN BY: RLL 2-18-66
CHKD BY:
PROJ. ENG:

2718
PRODUCT

PART NAME: TERMINAL BOARD ASS'Y, AUX. REGULATOR
SIZE B
DWG. NO. 14523C
CHG 2

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS COMPANY CONFIDENTIAL. REPRODUCTION, DUPLICATION, OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY.

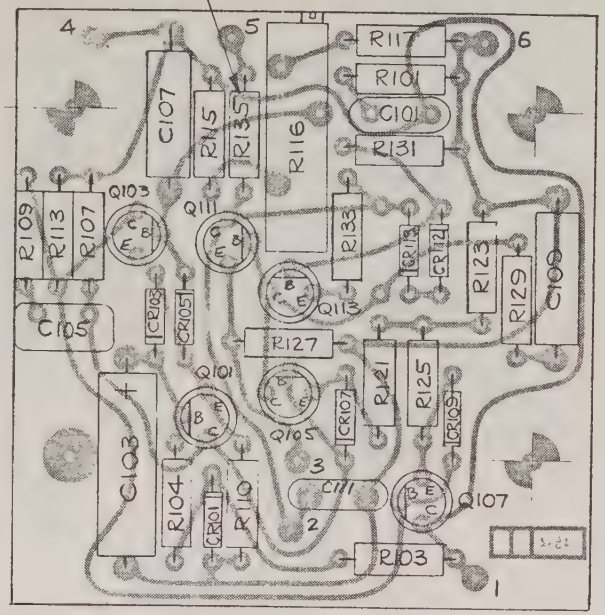
B 14535C 4A

BILL OF MATERIAL

ITEM	PART NO.	DESCRIPTION	QTY	E-E
1	14534	CIRCUIT BOARD	1	—
2	EHW108	TRANSIPAD	6	—
R101	ER945	RESISTOR, 10Ω	1	.500
R103	ER270	,4.7K	3	↕
R104	ER823	,560Ω	1	↕
R107	ER270	,4.7K	—	↕
R109	ER1005	,33Ω	1	↕
R110	ER295	,2.4K	1	↕
R113	ER270	,4.7K	—	↕
R115	ER182	RESISTOR, 10K	2	.500
R116	ER829	POTENTIOMETER, 1K	1	—
R117	ER164	RESISTOR, 3.9K	1	.500
R121	ER159	,680Ω	2	↕
R123	ER182	,10K	—	↕
R125	ER159	,680Ω	—	↕
R127	ER820	,27K	1	↕
R129	ER824	,47Ω	1	↕
R131	ER671	,20K	1	↕
R133	ER56	,820Ω	1	↕
R135		RESISTOR, SEE LEGEND	—	.500
C101	EC324	CAPACITOR, .05μF	1	—
C103	EC242	10μF	1	.900
C105	EC106	680pF	1	—
C107	EC314	.1μF	2	.687
C109	EC314	.1μF	—	.687
C111	EC213	CAPACITOR .02μF	1	—
CR101	ECR63	DIODE, 1N936 (ZENER)	1	.375
CR103	ECR31	,1N456	6	↕
CR105	ECR31	,1N456	—	↕
CR107	ECR31	,1N456	—	↕
CR109	ECR31	,1N456	—	↕
CR112	ECR31	,1N456	—	↕
CR113	ECR31	DIODE ,1N456	—	.375
Q101	EQ130	TRANSISTOR, 2N3904	5	—
Q103	EQ130	,2N3904	—	—
Q105	EQ130	,2N3904	—	—
Q107	EQ130	,2N3904	—	—
Q111	EQ130	,2N3904	—	—
Q113	EQ127	TRANSISTOR, 2N3906	1	—

CHG	E O	CHANGE DESCRIPTION	BY DATE	CHK	APPR
4A	5471	REDRAWN. NO CHG.	ET 4/4/67	WN	GWM

SEE LEGEND



NOTES: 1. CIRCUITRY LOCATED ON FAR SIDE.
2. THIS DRAWING SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

LEGEND		
DASH NO.	R135	
	VALUE	PART NO.
-1	47Ω	ER824
-2	10Ω	ER945
-3	—	STRAP WITH EW-39 BUS WIRE.

ENDEVCO CORPORATION
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS
ANGULAR ± —
FRACTIONAL ± —
DECIMAL ± —

1 BREAK ALL SHARP CORNERS .005 MAX
2 SURFACE ROUGHNESS 63 MICROINCH RMS MAX
3 DIAMETERS TO BE CONCENTRIC WITHIN .005 T I R
4 FILLET RADIUS .010 MAX

SCALE 2/1 — DUPLICATE SCALE DRAWING

MATERIAL LISTED
FINISH ——

DRAWN BY RLL 3.7.66
CHKD BY WN
PROJ ENG GWM

2622C
2718
PRODUCT

PART NAME +30V POWER SUPPLY CIRCUIT BOARD ASSEMBLY

SIZE B — DWG NO 14535C — CHG 4A

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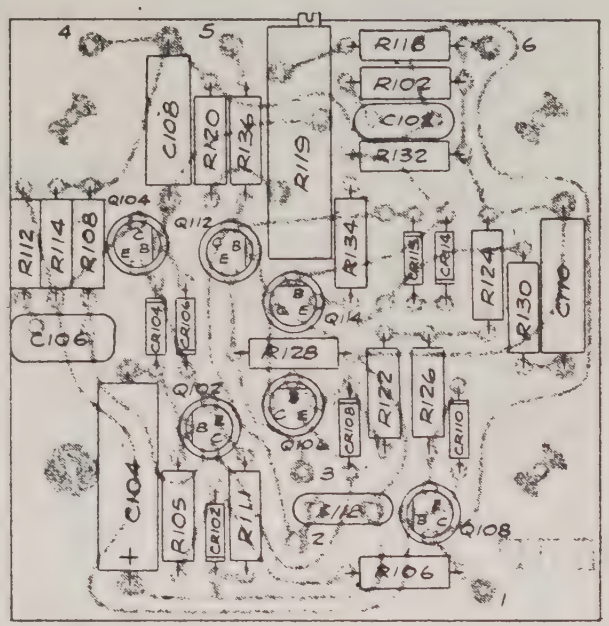
B-14536C 5

BILL OF MATERIALS

ITEM	PART NO	DESCRIPTION	QTY	$ - ¢
1	14534	CIRCUIT BOARD	1	—
2	EHW108	TRANSIPAD	6	—
R102	ER945	RESISTOR, 10Ω	1	.500
R105	ER823	560Ω	1	
R106	ER270	4.7K	3	
R108	ER270	4.7K	—	
R111	ER295	2.4K	1	
R112	ER1006	33Ω	1	
R114	ER270	4.7K	—	
R118	ER164	RESISTOR, 3.9K	1	.500
R119	ER829	POTENTIOMETER, 1K	1	
R120	ER862	RESISTOR, 10K	2	.500
R122	ER559	680Ω	2	
R124	ER862	10K	—	
R126	ER559	680Ω	—	
R128	ER820	27K	1	
R130	ER824	47Ω	2	
R132	ER671	20K	1	
R134	ER56	820Ω	1	
R136	ER824	RESISTOR, 47Ω	—	.500
C102	EC324	CAPACITOR, .05μF	1	—
C104	EC242	10μF	1	.900
C106	EC106	680pF	1	—
C108	EC314	.1μF	2	.687
C110	EC314	.1μF	—	.687
C112	EC273	CAPACITOR, .02μF	1	—
CR102	ECR63	DIODE, IN936 (ZENER)	1	.375
CR104	ECR31	IN456	6	
CR106	ECR31	IN456	—	
CR108	ECR31	IN456	—	
CR110	ECR31	IN456	—	
CR114	ECR31	IN456	—	
CR5	ECR31	DIODE, IN456	—	
Q102	EQ127	TRANSISTOR, 2N3906	4	—
Q104	EQ127		—	—
Q106	EQ127		—	—
Q108	EQ127	2N3906	—	—
Q112	EQ216	2N5400	1	—
Q114	EQ130	TRANSISTOR, 2N3904	1	—



NOTES:
1. CIRCUITRY LOCATED ON FARSIDE
2. THIS DRAWING SUBJECT TO FUTURE CHANGE WITHOUT NOTICE

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
4A	547	REDRAWN, NO CHG.	JC 11/66	WN	GWM
5	X44	Q112 WAS 2N3906 (EQ127)	RR 12/17	WN 1/25	GWM

ENDEVCO
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED
LIMITS OF DIMS
ANGULAR ±
FRACT MAX
DEC MAX
1. REMOVE ALL SHARP EDGES .005 MAX
2. SURFACE FINISH 63 MICRO INCHES MAX
3. CHAMFER ON FREE EDGES .010 X 45° MAX
4. REMOVE BURRS .010 MAX

SCALE 2X — FOR SCALE DRAWING

MATERIAL LISTED
FINISH

DRAWN BY RLL 3-8-66
CHKD BY WN
PROJ ENG GWM

•2718 — PRODUCT

PART NAME -30V POWER SUPPLY
CIRCUIT BOARD ASSEMBLY

SIZE B — DWG NO 14536C — CHG 5

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS ENDEVCO CONFIDENTIAL. REPRODUCTION, PUBLICATION OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY

LIST OF MATERIAL		QUANTITY	
ITEM	PART NO.	DESCRIPTION	-1 / -2
I101	EIT 123	INDICATOR LIGHT	1 / 1
R96, R97	EB1532	POTENTIOMETER, 5K	1 / 1
R99	EB827	POTENTIOMETER, 2K	1 / 1
R205	EB226	POTENTIOMETER, 5K	1 / 1
S2	EB549	SWITCH ASSY	1 / 1
S4	EB536	SWITCH	1 / 1
S5	EB537	SWITCH	1 / 1
S101	EB537	SWITCH, PUSH	1 / 1
R17	EB139	RESISTOR, 100K	1 / 1
1	EW170	WIRE 26 AWG, 7/32	2 / 2
2	15386	RIGHT PLATE	1 / 1
3	15387	METAL CAL	1 / 1
4	MS457	POT BRACKET	1 / 1
5	10574	PANEL BEARING	2 / 2
6	EW161	RIVET, RETAINING, EIT 3/8	2 / 2
7	EW159	LUG, SOLDER	2 / 2
8	EW160	DIAL	1 / 1
9	14146	BRACKET, CHARGE CONVERTER	1 / 1
10	MS456	KNOB, INDICATOR	3 / 3
11	15389-1	MAIN HARNESS	1 /
12	MS3509	FASTENER, TURN-LOC	2 / 2
13	EW28	GROMMET	1 / 1
14	EW59	BUS WIRE	1" / 1"
15	EN376	SCREW, 4-40 X 3/16	5 / 5
16	14775	DRESS NUT, MODIFIED	1 / 1
17	FW1187	WASHER FLAT 1/4 OD	1 / 1
18			1 / 1
19	EW166	LOCKWASHER, EIT #8	2 / 2
20	SW373	6" MAINS EXTENDER	2 / 2
21	EE115	FEED-THRU	2 / 2
22	EE134	TERMINAL, INSULATED	2 / 2
23	EW170	WIRE 22 AWG, WHT/BLK	5" / 5"
24	EW33	" BRN	3½" / 3½"
25	EW40	" BLU	4" / 4"
26	EW35	" WHT	6½" / 6½"
27	EW127	" WHT/BRN	8" / 5"
28	EW22	" YEL	8" / 5"
29	EW36	" GRY	4" / 4"
30	EW126	" WHT/RED	4" / 4"
31	EW128	" WHT/ORN	5" / 5"
32	EW234	" WHT/YEL	5½ / 5½
33	EW160	" WHT/GRN	5" / 5"
34	EW133	" WHT/BLU	6" / 6"
35	EW240	" WHT/VIO	6" / 6"
36	EW125	WIRE " WHT/BLK	6½ / 6½
37	EN268	SCREW, 4-40 X 1/8	2 / 2
38	EHW189	LOCK WASHER, 3/8	2 / 2
CB	EC479	CAPACITOR, 5.4 μF	1 / 1
C12	EC427	CAPACITOR, 2300 μF	1 / 1
S1	14189C	SWITCH, ASSY C.F. CUTOFF	1 / 1
S3	14188C	SWITCH, ASSY RANGE	1 / 1
do	EW236	WIRE, WHT/YEL	24" / 24"
do	EW33	WIRE, BRN	12" / 12"

FROM	TO
S2B-1	LUG 30*
S1A-7	C12(+)
S1A-2	CB
S1A-4	S3B-8
S1A-7	S3A-7

FROM	TO
S5-6	S101-2
C12(-)	

REVISIONS			
		RELEASED	BY
2	5/66	ITEM 10, CLIP MASTED ITEM 27, ITEM NUMBERS CHANGED, 1 CKT ADDED ITEM 29 & 31 ADDED, ITEM 30 CHANGED TO 26	
3	8/66	HIGH FREQ CUTOFF WAS .003, .005 & .007 B WAS .003, .005 & .007	
4	10/66	5A OF " WAS 5	
5	12/66	CHG WHT/BRN WIRE AT S2-B (6) TO SHIELDED CABLE; QTY 6 WAS 5 AT ITEM 7 HOOKUP	

SHOCK AMPLIFIER
ALL SOLID STATE

power
low freq cutoff
.003 .005 .007
gain
high freq cutoff
3300 5500 10000
cal-b
full scale g, psi, lb
7500 3000 1500
750 300 150
75000 30000 15000
10000 4000 2000
operate
pC/g, psi, lb
zero
gain adjust

ENDEVCO model 2718A

DETAIL "A"

NOTE: WIRES FROM DECKS C, D, AND F OF S3 ARE FROM MAIN HARNESS (ITEM 11)

S1-A S1-B S2-A (FRONT) S2-B (REAR) S3-A S3-B S3-E S3-F S3-C S3-D

MARK RED
WHT/BLK TO LUG 23
WHT/BLK TO ITEM 7 (GROUND WIRE)
WHT/BRN
WHT/ORN
WHT/RED
WHT/YEL
WHT/GRN
WHT/BLU
WHT/VIO
YEL MARK
MARK RED LEAD
MARK GRN LEAD
MARK SB-C LEAD
WHT/BLK SB-D

NUT 3/8-32 (SUPPLIED W/SWITCH)
POSITION "10"
LOCKWASHER THIS SIDE (SUPPLIED W/SWITCH) TWO PLACES TYP
C12
CB
BRN
YEL
BLU
WHT/BLK
WHT/ORN
WHT/YEL
WHT/GRN
WHT/BLU
WHT/VIO
RED
GRN
GRY
VIEW C-C
REF
USE LOCKWASHER (NOT SUPPLIED WITH R59
R59
R206
S101
S5
S4
S2
S3
6 (TOTAL) W/BLK WIRES TO LUG "A"
SECTION A-A
CUT WIRES TO LENGTH SHOWN STRIP 1/4" & TIN BEFORE INSTALLATION.
I101
RETAINER RING SUPPLIED WITH EIT 23
LOCK WASHER SUPPLIED WITH EHW189
LOCKWASHER MARK WITH R205
SECTION B-B

NOTES:
1. ALL WIRE HOOKUP FROM HARNESS 15389 UNLESS AS NOTED
2. USE -1 QTY FOR 2718A STD.
   -2 QTY FOR 2718AT.
3. DISTANCE OF THE BOTTOM EDGE OF THE KNOB (ITEM 10) FROM METAL CAL (ITEM 3), 3 KNOBS BENDED DOWN MAY BE UP TO 1/16"

ENDEVCO CORPORATION			
Pasadena, California			
SPECIFICATIONS UNLESS OTHERWISE NOTED			
LIN TOL OF DIMS	1. BREAK ALL SHARP CORNERS .005 MAX. 2. SURFACE ROUGHNESS 63 MICROINCH .005 MAX. 3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. 4. FILLET RADIUS .015 MAX.		
ANGULAR ±			
DECIMAL ±	SCALE 1:1	DO NOT SCALE DRAWING	
MATERIAL	U5760	DESIGN BY EET 7/14/67	
FINISH		DRAWN BY	
		TRACED	
PART NAME	FRONT PANEL ASSEM	SIZE D	DWG NO 15388C
PRODUCT			REV 5

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LIST OF MATERIALS

ITEM	PART NO	DESCRIPTION	QTY
C113	EC325	CAPACITOR, 80uF	2
C114	EC325	CAPACITOR, 80uF	—
C121	EC456	CAPACITOR, 250uF	2
C122	EC456	CAPACITOR, 250uF	—
CR117 -120	ECR79	DIODE, QUAD	2
CR127 -130	ECR79	DIODE, QUAD	—
Q119	EQ131	TRANSISTOR, 2N3766	1
Q120	EQ129	TRANSISTOR, 2N3740	1
R137	ER832	RESISTOR, 1.5Ω	2
R138	ER832	1.5Ω	—
R142	ER1493	5Ω	2
R143	ER1493	5Ω	—
R144	ER974	10Ω	2
R145	ER974	RESISTOR, 10Ω	—
1	15432	SHIELD, POWER SUPPLY	1
2			
3	EH385	SCREW, 6-32 X 2-1/2	3
4	EH326	SCREW, 6-32 X 3/8	6
5	EH317	SCREW, 4-40 X 1/4	2
6	EHW161	WASHER, FLAT #6	3
7	EHW14	SPACER, FIBER	9
8	EHW165	LOCKWASHER, EXT #6	7
9	EHW164	LOCKWASHER, EXT #4	2
10	EHL5	LUG, SOLDER #6	2
11	EHW176	WASHER, MICA	4
12	EHB27	SHOULDER WASHER	4
13	EHN66	NUT, HEX 6-32	9
14			
15			
16	14523C	TERMINAL BOARD ASSEMBLY	1
17	EW83	TUBING, TEFLON (BLU)	2-1/2"
18	EW39	#22 AWG, BUS WIRE	6-1/2
19	EW124	WIRE, VINYL, WHT/RED	5-3/4
20	EW124	WHT/RED	6-3/4
21	EW128	WHT/ORN	6-1/2
22	EW128	WHT/ORN	6-1/2
23	EW125	WHT/BLK	4
24	EW160	WHT/GRN	2-5/8
25	EW33	BRN	3
26	EW122	YEL	3-7/8
27	EW244	WHT/VIO	2-1/2
28	EW32	BLK	4-1/2
29	EW36	#22 AWG, WIRE, VINYL, GRY	3
—	—	LEAD OF R140 (SLEEVED)	—
—	—	LEAD OF R141 (SLEEVED)	
30	14622	POWER SUPPLY HARNESS (HARNESS #3)	1

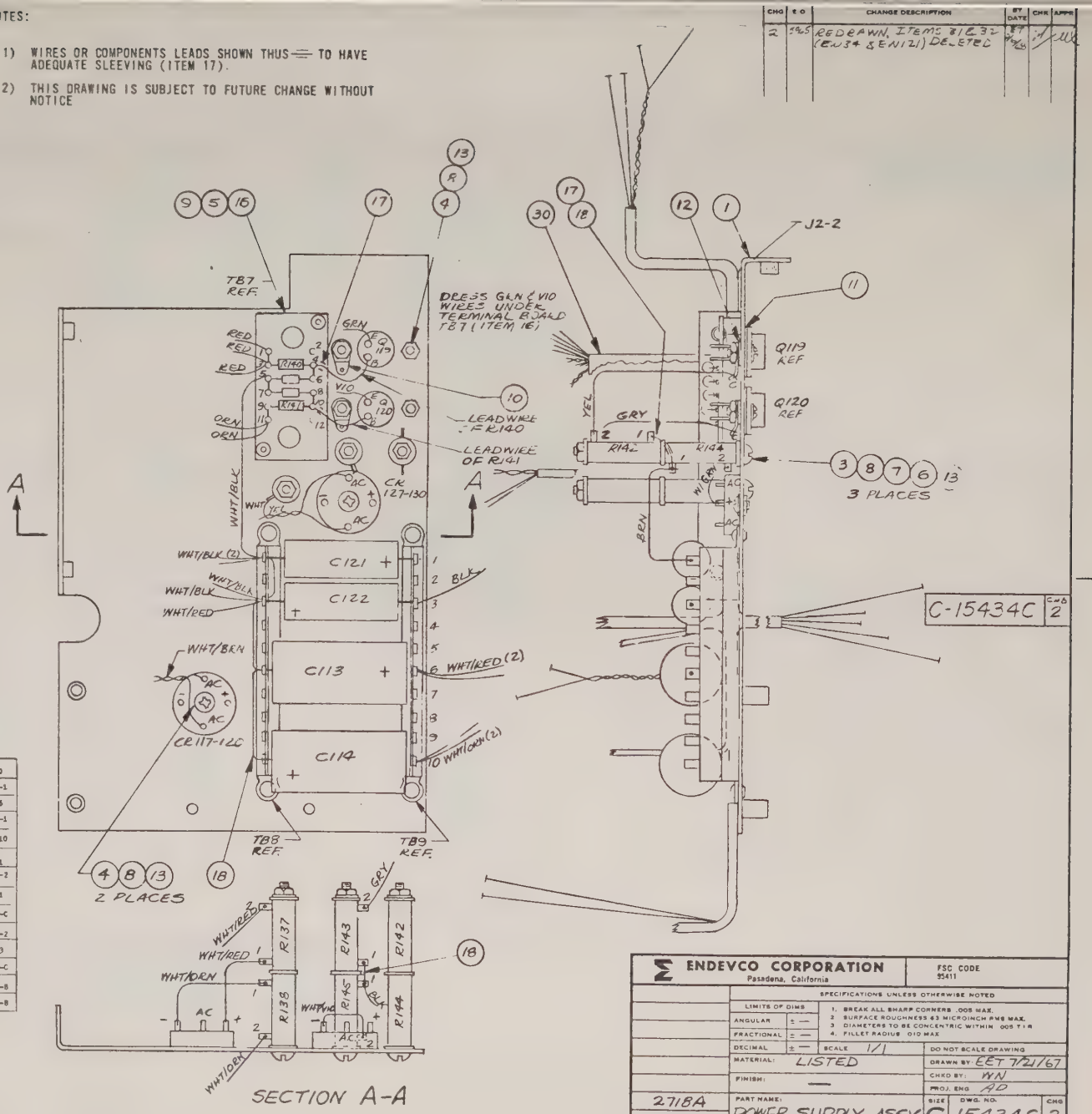
FROM	TO
CR117 -120 ⊕	R137-1
R137-2	TB9-6
CR117 -120 ⊖	R138-1
R138-2	TB9-10
TB7-5	TB8-1
CR127 -130	R144-2
R144-1	TB9-1
R142-2	Q119-C
CR127 -130 ⊖	R145-2
R145-1	TB9-3
R143-2	Q120-C
TB7-8	Q119-B
TB7-10	Q120-B

NOTES:

(1) WIRES OR COMPONENTS LEADS SHOWN THUS ═ TO HAVE ADEQUATE SLEEVING (ITEM 17).

(2) THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE

CHG	ECO	CHANGE DESCRIPTION	BY DATE	CHK	APPR
2	1965	REDRAWN, ITEMS 31 & 32 (EW34 & EN121) DELETED	EET 7/21/67	WN	MM



ENDEVCO CORPORATION, Pasadena, California		FSC CODE 95411	
SPECIFICATIONS UNLESS OTHERWISE NOTED			
LIMITS OF DIMS	1. BREAK ALL SHARP CORNERS .005 MAX. 2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX. 3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. 4. FILLET RADIUS .010 MAX		
ANGULAR ± —			
FRACTIONAL ± —			
DECIMAL ± —	SCALE 1/1	DO NOT SCALE DRAWING	
MATERIAL: LISTED		DRAWN BY: EET 7/21/67	
FINISH: —		CHKD BY: WN	
		PROJ. ENG AD	
2718A PRODUCT	PART NAME: POWER SUPPLY ASSY.	SIZE C	DWG. NO. 15434C CHG 2

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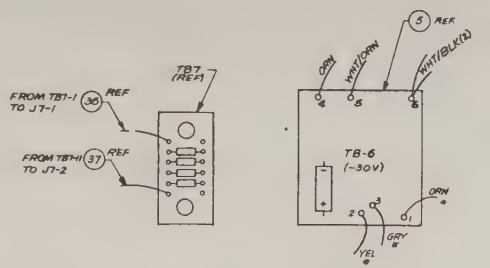
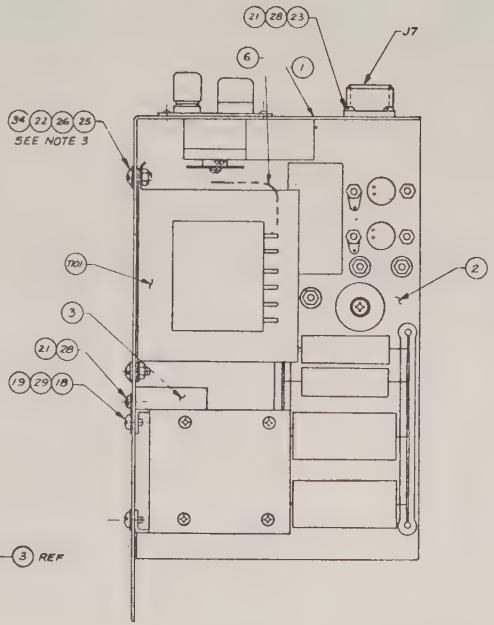
12/66 DIETERICH POST CLEARPRINT 1000M-10

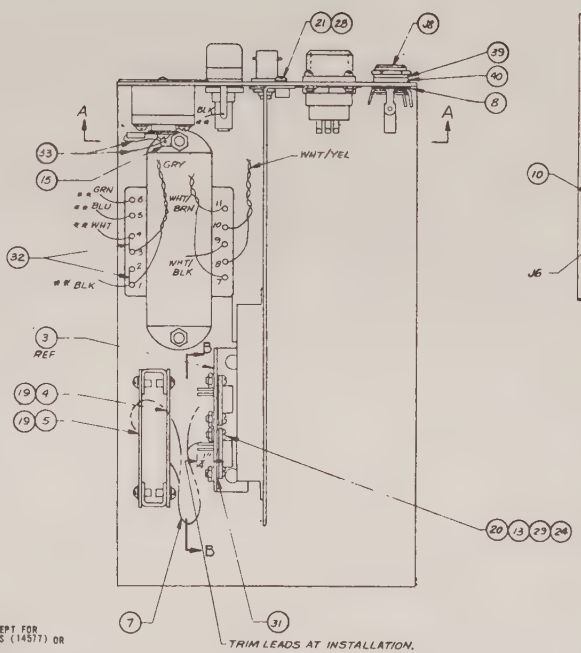
LIST OF MATERIALS

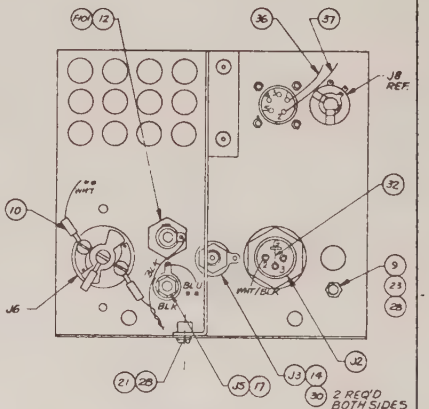
ITEM	PART NO	DESCRIPTION	QTY
J2	EJ75	CONNECTOR	1
J3	EJ15	BNC CONNECTOR	1
J5	EJ42	BINDING POST	1
J7	EJ251	RECEPTACLE	1
J8	EJ254	JACK	1
F101	EF16	FUSE	1
Q109	EQ131	TRANSISTOR 2N3788	1
Q110	EQ129	TRANSISTOR 2N3740	1
T101	14513	POWER TRANSFORMER	1
1	15433	BASE	1
2	15434	POWER SUPPLY ASSEMBLY	1
3	14771	HEAT SINK	1
4	14535C	CIRCUIT BOARD ASSY +30V(TB5)	1
5	14536C	CIRCUIT BOARD ASSY -30V(TB6)	1
6	14578	PRIMARY HARNESS (#1)	1
7	14677	30V SUPPLY HARNESS (#2)	1
8	EHW59	WASHER, SHOULDER, FIBER	1
9	EE120	TERMINAL, THREADED	1
10	EE59	TERMINAL, SOLDERLESS	3
11			
12	EF2	FUSE HOLDER	1
13	EHW27	WASHER, SHOULDER	4
14	EHL8	LUG, GROUND	1
15	EHL13	LUG, GROUND	1
16	EHL9	LUG, SOLDER	2
17	EHL31	LUG, SOLDER	1
18	EHW178	BRACKET, CIRCUIT BOARD	2
19	EH318	SCREW, 6-32 X 1/4	10
20	EH326	" 8-32 X 3/8	4
21	EH333	" 4-40 X 3/8	10
22	EH358	SCREW, 8-32 X 1/2	2
23	EHN65	NUT, HEX 4-40	5
24	EHN68	NUT, HEX 6-32	4
25	EHN67	NUT, HEX 8-32	2
26	EHW165	LOCKWASHER, EXT #8	2
27			
28	EHW164	LOCKWASHER, EXT #4	11
29	EHW165	LOCKWASHER, EXT #8	4
30	EHW168	LOCKWASHER, INT 3/8 ID	2
31	EHW178	WASHER, MICA	2
32	EW39	WIRE, BUS, 22 AWG 3/4 LG	3
33	EW37	WIRE, 22 AWG, VINYL GRN	2 1/2
34	15449	WASHER, SPECIAL	4
35	EF26	FUSE	(DPT) 2*
36	EW34	WIRE, VINYL, RED #22 AWG	2*
37	EW121	WIRE, VINYL, ORN #22 AWG	5*
38			
59	EHW54	WASHER, FLAT	1
60	EHW58	WASHER, FLAT, NYLON	1

QUAN	REVISIONS	BY	DATE
6A	REDRAWN, NO CHANGE		
7	ITEM 35 WAS F-189, 8/8/69 DELETED ITEM 23		

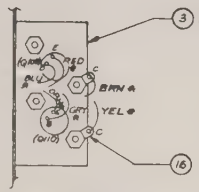








SECTION A-A



VIEW B-B

NOTES

(1) ALL WIRE HOOKUP IS FROM POWER SUPPLY HARNESS #14822, EXCEPT FOR THOSE MARKED WITH (*) WHICH COMES FROM 30V SUPPLY HARNESS (14577) OR MARKED WITH ** WHICH COMES FROM PRIMARY HARNESS (14576).

(2) FOR 230V, REMOVE ITEM 32 JUMPER BETWEEN TERMINALS 3 AND 4 AND 1 AND 2 ON T101. PLACE JUMPER BETWEEN 2 AND 3. REPLACE F101 WITH ITEM 35

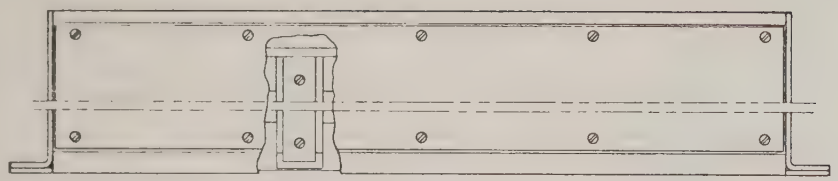
⚠3 TORQUE ITEM 25 TO 20 IN LBS - TWO PLACES. SMOOTH MOUNTING SURFACE OF TRANSFORMER T101 BY REMOVING THE BLOBS AND TEARS. IF BARE METAL IS EXPOSED, SPRAY WITH CLEAR ACRYLIC LACQUER. SANDWICH FEET OF T101 BETWEEN TWO SPECIAL WASHERS ITEM 34

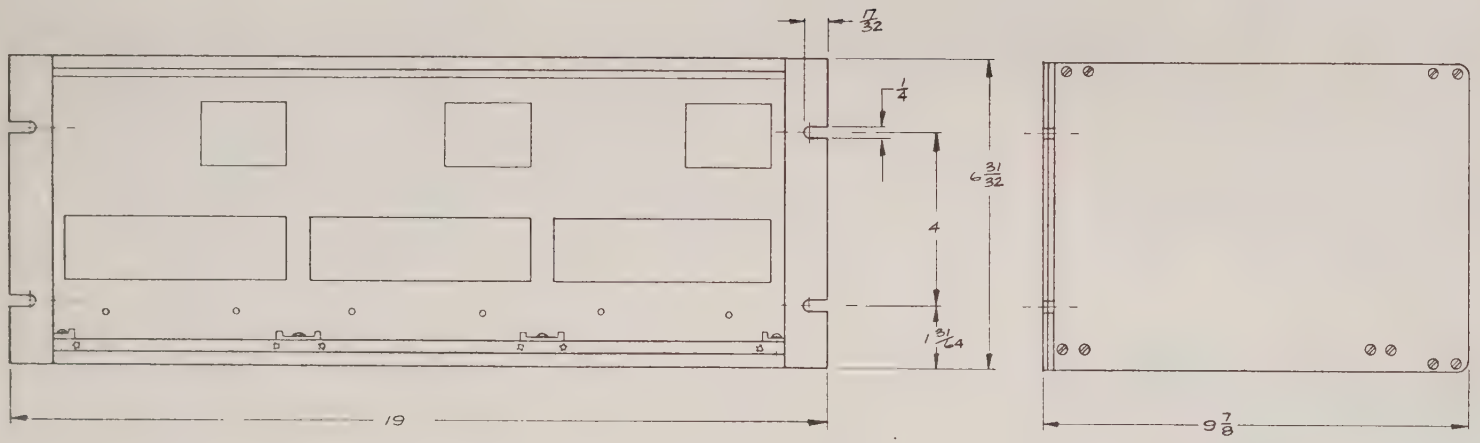
0-15445C | 7

ENDEVCO — SPECIFICATIONS UNLESS OTHERWISE NOTED
UNITS OF ONE: 1. BREAK ALL SHARP EDGES AND BURR
ANGULAR ± — 2. SURFACE ROUGHNESS IS 63 CHEMICAL FINISH
FRACTIONAL ± — 3. DIMENSIONS TO BE COMPLETE BEFORE ANY PLATING OR FINISH
DEC MAL ± — DO NOT SCALE DRAWING
MATERIAL SEE L W — DRAWN BY FEB 7 '67
FINISH — CHECKED BY
APPD BY A.V.
2710A — PRELIMINARY ASSEMBLY — SIZE D — DWG NO 15445C — REV 7

ITEM	PART NO.	DESCRIPTION	QTY
1	4992A	RACK	1
2	EH127	SCREW, OVAL HEAD 10-32 x 1/2	4
3	EHW175	WASHER, CUP	4
4	EHW144	CUP WASHER FILLER	4
5	1478G	POWER CORD, TRIPLE CONNECTOR)	OPT
6	1471B	BLANK FACE PLATE ASSEMELY	OPT.

CHG	E.O.	CHANGE DESCRIPTION	DATE	CHK	APP'D
1	5484	RELEASED	E* 8/21/67		





C-4992A-C | 1

THIS DRAWING IS SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

ENDEVCO CORPORATION
Pasadena, California

FSC CODE 95411

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS
ANGULAR ± —
FRACTIONAL ± 1/32
DECIMAL ± —

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R
4. FILLET RADIUS .010 MAX

SCALE 1/2 SIZE — DO NOT SCALE DRAWING

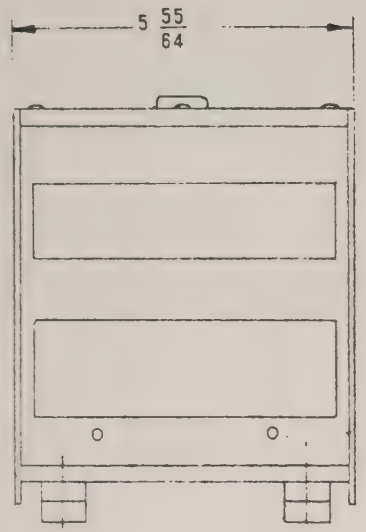
MATERIAL:
DRAWN BY EET 8/21/67
FINISH. GREY ENAMEL
CHKD BY
PROJ. ENG.

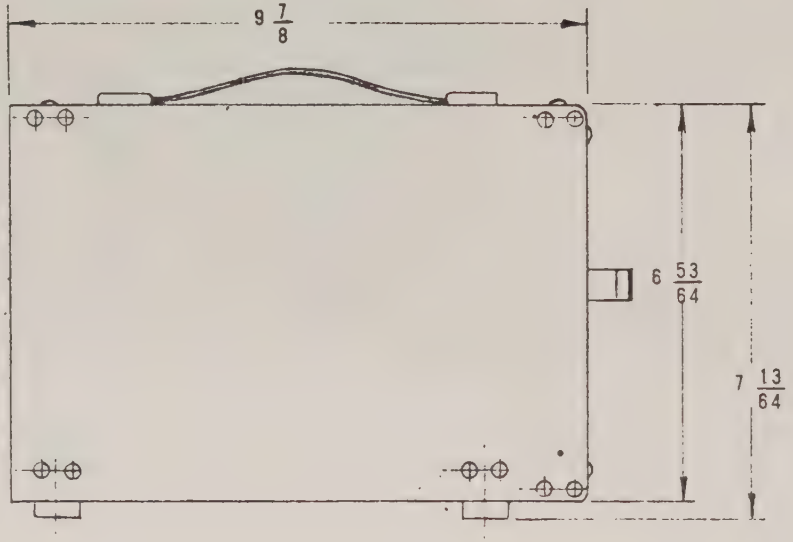
PRODUCT
PART NAME: RACK
SIZE C | DWG. NO. 4992A-C | CHG 1

11/64 SKETCHBOOK-POST CLEARPRINT 3888H

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
1	4953	RELEASED	11-4-67	[illegible]	[illegible]
1A	7019	ADDED NOTE 2	1-4-68	[illegible]	[illegible]

B-2991A-C 1A





NOTES

(1) THIS DRAWING SUBJECT TO FUTURE CHANGE WITHOUT NOTICE

(2) THIS CARRYING CASE IS USED WITH ONE 2718A.

ENDEVCO Pasadena, California
Subsidiary of Becton, Dickinson and Company B-D

FSC 95411

DO NOT SCALE DRAWING

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS.	
ANGULAR	±
FRACTIONAL	± 1/16
DECIMAL	±

1. BREAK ALL SHARP EDGES .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T. I. R.
4. HOLE TOLERANCE PER AND10367
5. ALL DIMENSIONS IN INCHES
6. FILLET RADIUS .010 MAX.

SCALE: 1/2

MATERIAL: ALUMINUM

FINISH: BLACK ANODIZE

DRAWN BY: CEH 11-3-67

CHKD BY: CEH 11-4-67

PROJ ENG: [illegible]

PART NAME: SINGLE CARRYING CASE

SIZE: B | DWG NO.: 2991A C | CHG: 1A

PRODUCT

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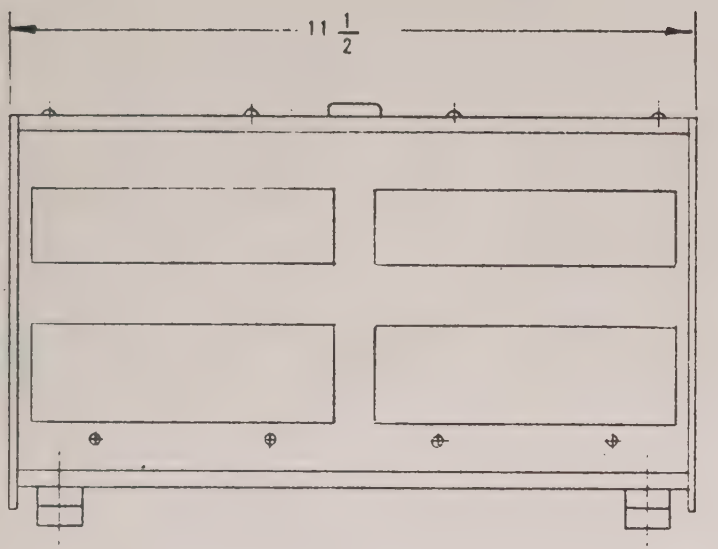
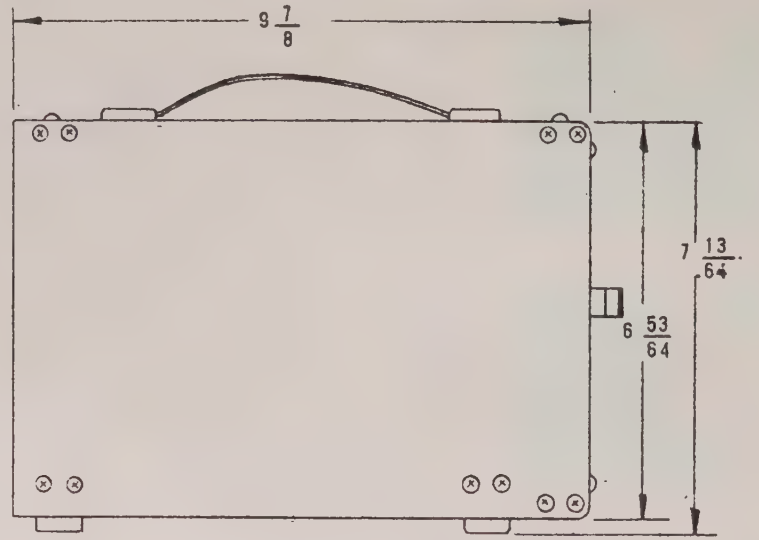
B-2992A-C | 1A

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
1	4453	RELEASED	11/4/	[illegible]	PJ
1A	7019	ADDED NOTE 2	11-9-69	[illegible]	PJ





NOTES

(1) THIS DRAWING SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.

(2) THIS DUAL CARRYING CASE IS USED WITH (1) 2718A AND (1) 2954A OR TWO OF EITHER UNITS.

ENDEVCO Pasadena, California
Subsidiary of Becton, Dickinson and Company B-D

FSC 95411

DO NOT SCALE DRAWING

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS.	
ANGULAR	±
FRACTIONAL	±1/16
DECIMAL	±

1. BREAK ALL SHARP EDGES .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .005 T. I. R.
4. HOLE TOLERANCE PER AND 10387
5. ALL DIMENSIONS IN INCHES
6. FILLET RADIUS .010 MAX.

SCALE: 1/2

MATERIAL: ALUMINUM

FINISH: BLACK ANODIZE

DRAWN BY: GEN 10-3-69

CHKD BY: [illegible] 11-9-69

PROJ ENG: PJ

PART NAME: DUAL CARRYING CASE

SIZE: B

DWG NO.: 2992A-C

CHG: 1A

PRODUCT

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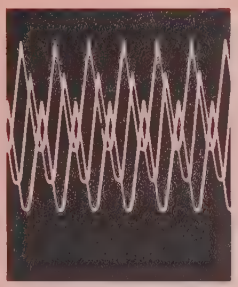

DRIVING GALVANOMETERS

1. Frequency Response

The first decision in selecting the proper galvanometer is determined by the range of frequency response which is required.

The galvanometer frequency response is found in the tables provided by the manufacturer, such as C.E.C., Honeywell or Midwestern. These show the frequency range for 64% critical damping. This damping provides the greatest range for flat response and minimum error due to phase shift.

Fluid-damped, rather than magnetically-damped, galvanometers are usually used for vibration measurement because the high frequency response is much better. Fluid-damped galvanometers go to 5000 Hz and sometimes higher. The top limit for magnetically-damped galvanometers is 200 - 300 Hz. However, the magnetically-damped galvos are much more sensitive.

2. Damping Resistance

The required damping resistance is specified on the manufacturer's tables for each galvanometer. This is the resistance seen by the galvanometer looking back into the driving circuit. It is determined by the source resistance of the driving amplifier and any series or parallel resistors between the amplifier and the galvo.

ENDEVCO DYNAMIC INSTRUMENT DIVISION

801 S. ARROYO PARKWAY • PASADENA, CALIF. 91109 • PHONE (213) 795-0271

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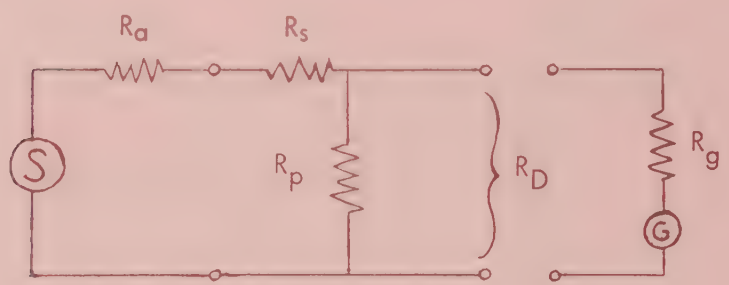
TWX 910 588-3272 TELEX 67-5465 CABLE ENDEVCO DIVISION OF BECTON, DICKINSON AND COMPANY PRINTED IN U.S.A.

a. Damping - Fluid-Damped Galvanometers

For fluid-damped galvanometers the electrical damping is only a small per cent of the total damping. The damping resistance can be varied from 3 to 100 ohms. This is the Honeywell specification and is valid for most C.E.C. fluid-damped galvos even though their tables do indicate an optimum value. This means that no damping resistors are required for use with the ENDEVCO® amplifiers.

b. Damping - Magnetically-Damped Galvanometers

For magnetically-damped galvanometers the damping resistance specified by the manufacturer must be provided.



The above diagram illustrates the circuit.

R_a	=	source resistance of amplifier
R_g	=	terminal resistance of galvo
R_D	=	required damping resistance
R_s	=	series resistance which may be required
R_p	=	parallel resistance which may be required

(1) Small Source Resistance - If R_a is less than R_D, we need only a series resistor and $R_s = R_D - R_a$.

(2) Series Resistor Inserted To Meet Amplifier Requirements - With some amplifiers, a series resistor R_s will be required by the amplifier and a parallel resistor will be required to provide the proper damping resistance.

So that $$R_p = \frac{(R_s + R_a)\ R_D}{(R_s + R_a) - R_D}$$

3. Sensitivity

Now we can establish the sensitivity of the system from the following formulas:

a. No parallel resistance being used:

$$\text{System Sensitivity} = \frac{G}{S_g R_T} \quad \frac{\text{pk in.}}{\text{pk mV}}$$

$$\text{or} = \frac{S_a G}{S_g R_T} \quad \frac{\text{pk in.}}{\text{pk g}}$$

Where: S_g = listed galvo sensitivity in mA/in.

R_T = total circuit resistance

$R_T = R_a + R_s + R_g$ in Ω

G = amplifier voltage gain

S_a = accelerometer sensitivity in pk mV/pk g

b. With parallel resistance R_p added:

$$\text{System Sensitivity} = \frac{G}{S_g R_{eq}} \quad \frac{\text{pk in.}}{\text{pk mV}}$$

$$\text{or} = \frac{S_a G}{S_g R_{eq}} \quad \frac{\text{pk in.}}{\text{pk g}}$$

Where: $R_{eq} = \frac{(R_p + R_g)(R_a + R_s)}{R_p} + R_g$

In either case, system sensitivity can be reduced by increasing R_s. Sometimes a potentiometer is inserted in series in order to continuously adjust the sensitivity.

The calculated sensitivity is nominal at best, and a calibration should be performed for the entire system. This can be done with the accelerometer on a shaker table mounted back-to-back with a standard accelerometer. Or, the transducer output can be simulated by inserting a known signal at the input of the amplifier.

Maximum Swing Before Overload

It is very important to make certain that there is no overloading in any part of the system. Voltage overloading of the amplifier will produce clipping. Current overloading of the amplifier causes distortion. Current overloading of the galvanometer can damage it. Some galvanometer specifications give a limit for galvanometer swing. All of these factors are pertinent to driving galvanometers with ENDEVCO® Amplifiers. However, some generalizations can simplify this consideration.

For fluid-damped galvanometers voltage overloading of the amplifier is the usual limiting factor.

For magnetically-damped galvanometers the galvanometer swing is the usual limiting factor.

a. Current Overloading of Galvanometer

With fluid-damped galvanometers the possibility of galvanometer overload can usually be ignored since ENDEVCO® Amplifiers are designed such that the current output will not exceed 100 mA, the usual safe limit listed by the manufacturers. With magnetically-damped galvanometers the possibility of current overload of the galvanometer should definitely be considered.

$$\text{maximum swing in pk in.} = \frac{\text{safe current specifications (mA)}}{\text{galvo sensitivity } (\mu\text{A/in.})} \times 10^3$$

b. Voltage Overloading of Amplifier

$$\text{maximum swing in pk in.} = \frac{\text{maximum voltage specification for amplifier in pk mV} \quad \text{system sensitivity in pk in./pk mV}}{\text{gain}}$$

See Paragraph 3.

c. Current Overloading Amplifier

When only series resistance is added:

$$\text{maximum swing in pk in.} = \frac{\text{maximum current specification for amplifier (mA)}}{\text{galvo sensitivity (mA/in.)}}$$

c. Current Overloading Amplifier (continued)

When parallel resistance R_p is added:

$$\text{maximum swing in pk in.} = \frac{\text{maximum current specification for amplifier (mA)}}{\text{galvo sensitivity in mA/in.} \quad \frac{R_p + R_g}{R_p}}$$

5. Use of Galvanometer as Filter

Galvanometers can be used as low pass filters. The characteristics of the cutoff curve depend on the per cent of critical damping. These curves can be found in the manuals supplied by C.E.C. or Honeywell. It should be noted that for damping other than at 64% of critical damping there will be a phase shift which has a non-linear variation with frequency. This phase shift can limit their usefulness as filters, especially in shock work.

For a magnetically-damped galvanometer the frequency response can be decreased by increasing the damping ratio. This can be easily accomplished by decreasing the resistance seen by the galvanometer. In fluid-damped galvanometers this cannot be done because only a small proportion of the damping is electrical.

6. ENDEVCO® Amplifiers with Galvo Drive Capability

2730G	Vibration and shock, ±5% to 20 kHz
2740	Shock, ±5% to 150 kHz
2760AG	Vibration and shock, ±5% to 20 kHz.

For additional information see Tech Data No. 543, "Worksheet for Selecting and Driving Fluid-Damped Galvanometers."

WARRANTY

Endevco warrants each new instrument to be free from defects in material and workmanship for one year from date of shipment to the original purchaser. This warranty does not extend to units that have been misused or used in violation of Endevco recommendations, or to units that have been altered or repaired outside Endevco's factory. Defects covered by this warranty will be remedied at no charge provided this instrument is delivered to the factory with all transportation charges prepaid. If upon examination it is found that the defect is not within the scope of this warranty, a statement of repair charges and a request for authorization to proceed with repair will be submitted.

Aaron Barnett

Manager
Quality/Reliability Control

Vice President
General Manager

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